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ABSTRACT

This technology/program matrix and annotated bibliography were created as a product of the first activity in a project to alert vocational educators to forthcoming technological changes and to promote awareness of vocational education as a mechanism for productivity improvement. The classification matrix identifies, describes, and classifies those technological advances that can be expected to alter job skills significantly and hence the corresponding training requirements. The bibliography describes articles about new and emerging technologies judged to have relevance for vocational education program offerings. Articles were selected according to the following admissibility criteria: the article describes a new technology or a change in an existing one that is in use or will be so in 3 to 5 years; the technology described requires acquisition of new knowledge and skills suitable for development at the subbaccalaureate level; and the article contains information in terms of vocational/technical occupations, labor force implications, or projections as to diffusion of the technology. Technologies are classified in seven major areas: computers and automated systems; information handling and telecommunications; agricultural technology; biomedical technologies; manufacturing; social/organizational technologies; and other areas. (KC)

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UTILIZING VOCATIONAL EDUCATION TO IMPROVE PRODUCTIVITY

Contract No 300810352

Technology/Program Matrix

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March 1, 1982

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A. Technology/Program Matrix

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DEVELOPMENTAL CONTEXT

OVERVIEW

Productivity and its improvement is a subject of intense nationwide concern. American business and industry is making a major commitment to new technology in an attempt to bolster sagging productivity. While technological advances are undeniably an important contribution, it is by no means a foregone conclusion that their introduction necessarily will ensure productivity growth. Although many new technologies may indeed result in labor savings, maximal benefit will accrue only if our nation's work force possesses the technical and managerial skills necessary to use new products and processes to competitive advantage.

In recognition of the need to alert vocational educators to forthcoming technological changes and to promote awareness of vocational education as a mechanism for productivity improvement, the Office of Vocational and Adult Education awarded a contract to investigate "Utilization of Vocational Education to Improve Productivity." Formal project activities include:

- identification of new and emerging technologies with relevance for vocational education;
- assessment of programmatic implications of new technologies for job skills training;
- preparation and dissemination of a series of working papers highlighting programmatic implications of identified new technologies;
- preparation and dissemination of monographs describing an expanded role for vocational education; and

- provision of on-going technical assistance to state and local vocational education agencies.

TECHNOLOGY/PROGRAM MATRIX AND ANNOTATED BIBLIOGRAPHY

The product of the first project activity is an annotated bibliography of articles descriptive of new and emerging technologies judged to have relevance for vocational education program offerings. To facilitate classification of the articles abstracted, a technology/program matrix has been developed. The classification matrix and the annotated bibliography are presented in Appendices A and B, respectively. Their purpose is to identify, describe and classify those technological advances that can be expected to significantly alter job skills and hence the corresponding training requirements. Articles are included to the extent necessary to document the presence of a new and emerging technology. In view of this purpose, the review should not be construed as a comprehensive investigation of all pertinent literature.

Articles were selected for bibliographic inclusion according to the following admissibility criteria:

- the article describes a new technology or a modification of an existing technology that is now in use or appears probable to become quite widespread in the next three to five years;
- the technology described requires or would appear likely to require acquisition of new knowledge and skills suitable for development at the sub-baccalaureate level; and
- the article contains relevant information, e.g., general descriptions of the technology, applicability in terms of vocational/technical occupations, labor force implications, or projections as to diffusion of the technology.

The technological/program matrix presented in Appendix A is a classification of annotated articles cross-tabulated by subject technology and relevant vocational program areas. To facilitate classification, technologies have been classified according to seven major technological growth areas:

- Computers and automated systems;
- Information handling and telecommunications;
- Agricultural technologies;
- Biomedical technologies;
- Manufacturing;
- Social/organizational technologies;
- Other.

Within each growth area, specific technologies have been identified and briefly described. These technologies serve as row headings. Column headings are defined by the seven major two-digit OE instructional program areas: Agriculture (01), Distribution (04), Health (07), Occupational Home Economics and Preparation for Occupation of Homemaking (09), Office (14), Technical (16), Trade and Industrial (17). Although new instructional codes are in the process of being implemented, conventional codes were used because of their greater field familiarity.

Thus, strictly speaking, there exists a separate matrix for each technological growth area. Each cell of every matrix contains article identification numbers classified according to the six-digit program code for which the technology described in the article is considered to be most relevant. The identification numbers correspond to specific entries in the annotated bibliography contained in Appendix B.

Articles that apply generally to all or a majority of the six-digit program codes within a specific two-digit program area are listed within a cell with no attempt at further classification. Those articles that pertain to several six-digit programs are classified under those programs considered to be impacted by the technology or technologies described by the article. Thus, one article may be multiply classified in a matrix and/or may appear in one or more technological area matrices.

USE OF THE MATRIX AND BIBLIOGRAPHY

The technology/instructional matrix (strictly speaking, a series of matrices) serves as an organizing framework for the literature surveyed. The technological area identifies a broadly defined technology field with implication for vocational/occupational skills preparation. Description of technologies within a specific area provide more definitive information as to the nature of the new or emerging technology and together with the area descriptors represents a taxonomy of technologies of concern to vocational education.

The matrix can be used for two separate purposes. Entering at the row level (a specified technology) will indicate which program areas are likely to be influenced by the specific technology. Alternatively, entry at the column level (program area) will provide information as to those growth technologies likely to impact on a specific program area. Both uses have direct application for vocational education programming.

PROCEDURE

A major activity centered on the determination of relevant literature citations. The first step in the survey process involved

selection of those periodicals to be subsequently reviewed. Approximately two thousand periodicals were identified by title as being of possible interest. Each periodical was tentatively classified into one or more of the seven major instructional program areas. Next, project staff reviewed selected issues to determine whether the periodical was likely to contain any relevant citations. The majority of titles were eliminated from further consideration according to one or more criteria: (a) too technical, speculative or general in scope and coverage of articles included; (b) articles pertained to foreign applications; and (c) content not applicable. Over three hundred titles remained for further consideration at the completion of the process.

Current issues (usually 1980 and 1981) of these periodicals judged likely to contain relevant information were reviewed. Title pages of periodical issues were examined, and those articles considered relevant were scanned. If the article was judged useful for project purposes, it was abstracted. Material that was too lengthiy and/or too detailed was photocopied. References in the articles reviewed occasionally identified journals or articles not included in the initial scan. These journals were then examined for relevance in the manner outlined above. Additionally, when a technological area began to be obviously important, index searches of bibliographic compendia were undertaken to identify other potentially useful references. The search was further augmented by a computerized search of the health area.

Appropriateness of any given article for abstraction/citation was judged by application of admissions criteria as previously defined. Each article summary was prepared on a separate sheet or card, which

provided for bibliographic identification, brief description of technologies concerned and identification of specific vocational program categories for which the technologies could have implications. A copy of the abstract card is included as Appendix C. Approximately two hundred and seventy-five articles were abstracted.

Upon completion of the literature abstracting, project staff reviewed the content and developed a preliminary taxonomic classification of the technologies identified. Technology categories judged to be too narrowly defined were combined into a more inclusive categories or, in some instances, excluded from further consideration. For those categories judged to be too broad, the categories were re-examined, and articles re-classified into categories of more limited breadth. These final categories were defined as the technologies of interest and were arranged under broad general headings (e.g., "Computers and Automated Systems"), and a preliminary draft matrix prepared.

In addition to literature sources, knowledgeable persons in business and industry were contacted for comments on technological change areas and their implications for job skills. These contacts were especially useful when a technological growth area was identified but project staff were unable to gain a clear understanding from the literature of the spread of the technology, its relevance for sub-baccalaureate workers, or when references in the literature were sparse or sketchy.

Based on input from these experts and on the recategorization and organization of abstracted articles, project staff evaluated each technology on three quantitative scales--applicability to vocational education, extent of current use, and assurance of wide diffusion within

the next several years. A copy of the scale is presented in Appendix D. Because of a strategy to include articles of dubious ultimate utility in the original search, not all articles were accorded a high rating. Articles receiving a low combined rating were excluded from the draft matrix. A revised matrix was then produced. Project staff again met to review the results of the task, and to make final judgements and revisions of the proposed matrix. The final matrix is shown in Appendix A.

As noted, specific technologies were grouped under broad technological area headings. Area headings are highlighted at the top of each matrix page. The specific technologies are named and briefly defined as row headings at the left of the matrix. The seven major vocational/technical program areas are listed along the top of each section or page, under the area heading, as column headings. Thus, each "cell" within the matrix associates a particular technology with a major vocational/technological education program area.

Article numbers comprise the cell entries. Each "cell" that contains entries may be further subdivided into one or more four-digit codes corresponding to a specific program within the major program heading. For this purpose, program codes correspond to those currently used on the Vocational Education Data System (VEDS) reporting sheets. Thus, for example, a cell in the column Technical (code 16) may have a subdivision ".0108" to indicate VEDS category 16.0108, "Electronic Technology." A copy of the instructional codes is given in Appendix E. When a job category was not represented in the VEDS list specifically, the division ".9900," "Other," was used. Subcategory divisions are shown in the matrix cells as four decimal digits, underlined; the

article numbers are given under the subdivision heading. When an article had implications for several vocational categories, it would appear in several cells or subdivisions. If the article gives implications of one technology for several different subcategories within a major program area, rather than listing it many times within a cell, two conventions were used: (a) if the implications cut across many categories of different kinds within the major area, these articles are listed first in the cell, without any subcategory heading; or (b) if the implications cut across subcategories within a category, and the VEDS list only lists the subcategories, the logical supracategory was used (for example, articles with implications for "nursing" in general (Health area) and not specifically for associate degree nurses (.0301), practical nurses (.0302), or nursing assistants (.0303), would be grouped under ".0300" in the "07" column.

Bibliographic annotations were prepared to accompany the matrix. The annotations provided in Appendix B, describe the general content of the articles cited. Articles are alphabetically arranged and assigned a sequential identification number. This number is used in the matrix and provides the link between the matrix and the bibliography.

APPENDIX A

Technology/Program Matrix

Area of Technological Growth and Development: COMPUTERS AND AUTOMATED SYSTEMS

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Digital Process Control Systems and components, usually supported by microprocessors or computers, which directly control simple or complex industrial processes. Includes numeric control, direct digital control and programmable control.	.0300 5	.1200 135	.0200 92		.0600 25	.0100 64 .0104 45 183 .0108 6 71 26 112 27 134 28 168 53 171 .0117 127 .9900 6 101 22 154 48 172 87 173 93	101 154 122 169 127 .0100 141 168 .1500 41 151 87 .2300 64 .1200 12 159 91 .9900 6 87 22 93 47 172 48 173
Microelectronic Monitors and Controls Instrument components or subsystems, supported by microprocessors, which control, monitor, or display a particular function or functions of a larger system or device.	.0100 114	.0400 7 29 .1000 59 187	.0300 73 75 .0500 75 .0900 73 75	.0204 187	.0600 25 133 37	.0108 37 90 .9900 77 114	114

Area of Technological Growth and Development: COMPUTERS AND AUTOMATED SYSTEMS

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Microcomputers Sometimes called "personal" computers. Self-contained, small-sized computers generally selling for under $5,000 to individuals and small businesses, or peripheral devices designed for interface with such computers.	.0100 5 71 63 72 70 138 .0300 138 163 .0500 79	.9900 85	.0199 121 .0300 115 160 .0900 115 .9900 155	.0108 131 146 .0299 131 146	14 28 18 181 43 .0100 29	.0108 23 130 96 133 106 142 .0117 155 .0300 160	.1500 110 123 133
Computer-based Design and Manufacture Computer-based systems which facilitate design or physical manufacture mainly of industrial parts and part assemblies. Includes computer-aided design (CAD), computer-assisted manufacture (CAM), and computer-integrated manufacture (CIM).						.0100 19 78 20 98 26 102 27 111 29 138 66 191 .0111 20 112 .0117 62	.1300 19 98 26 112 27 130 29 134 66 198
Robotics Robots (programmable machines which may perform a variety of complex movement and manipulation tasks), and systems incorporating robots in industrial applications.						.0108 15 49 16 83 29 105 3? 130 40 171 45	38 127 .1500 16 83 49

Area of Technological Growth and Development: COMPUTERS AND AUTOMATED SYSTEMS

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Robotics (continued)							.2306 15 49 29 175 40 .2607 49
Database Systems Computer systems and associated program products which may store and retrieve selected subjects of a large volume or variety of data by relatively simple user commands. Includes database management systems (DBMS), and distributed data processing (systems electronically linking many dispersed remote input/output terminals to one or more central computer archives and processors.		.0400 159 .1200 129 .3100 30 129	.0200 103 .0300 157 176 160 190 164 .9900 34 176		.0100 30 .0200 32 158 50 178 103 190 12[illegible] .0300 178 .0500 129	.0108 6 .0199 6 11 .0605 32 .9900 100	.9900 6
Software Computer programming techniques, programming languages, and the development and use of general or special purpose computer programs.					.0200 117 161	.0117 62 161 117	

Area of Technological Growth and Development: COMPUTERS AND AUTOMATED SYSTEMS

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Inventory Control Systems Sophisticated computer- or microprocessor-based peripheral devices, and encoding/decoding schemes which facilitate or automate either the physical movement or the input/output accounting of products in warehouses, supply centers, or sales outlets.		.0600 59 138 .0800 29 129			.0500 33 99 203		99

Area of Technological Growth and Development: **INFORMATION HANDLING AND TELECOMMUNICATIONS**

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Word Processing Computer-based systems and peripheral devices which facilitate document preparation with functions such as dynamic text editing, text formatting, and record updating and sorting.					.0300 118 196 130 197 .0700 14 181 81 189 128 196 130 197 .0900 189		
Optical Data Transmission Components and subsystems used mainly between local data-handling computers and devices, based upon fiber optic cables and pulsed laser signals.			.0300 176 .9900 176		.0200 99 .0400 9 96 57 152 89 .0700 189	.0104 183 .0108 9 139 57 170	.1400 35 .1500 9 151 .2306 82
Office Automation Systems and Components Devices such as micrographic recorders, facsimile transmission machines, and other information-handling equipment (excluding computers and word processors), or integrated information systems which may electronically link such devices, word processors, or computers together perform complex information transduction or transmission tasks, with applications in office environments.		.1200 189			14 120 18 127 42 128 57 149 81 178 84 181 96 186 109 189 .0700 14 120 186	.0117 127	

Area of Technological Growth and Development: INFORMATION HANDLING AND TELECOMMUNICATIONS

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Videotex Centrally-originating cable or broadcast information systems which provide subscriber-controlled displays. Includes teletext (systems which only provide information displays) and viewdata (which allow subscribers to send information back to the vendor over the same system).		.0100 44 125 59 188 119 .0800 59 .1269 125 .0800 125 188 .2000 125 188		.0104 119 .0299 119	.0400 1 44		.1900 110

Area of Technological Growth and Development: AGRICULTURAL TECHNOLOGIES

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Micropropagation and Genetic Engineering Processes which produce living plants with pre-planned genetic characteristics, either through gene alteration (genetic engineering) or culturing of spores, cells or germ plasm (e.g., cloning).	.0100 13 95 58 113 72 137 80 162 .0200 80 137 .0400 80					.0199 23 80	
Soil-less Plant Propagation Systems and techniques for producing plants without using soil as a rooting substrate, such as hydroponics.	.0400 56 156 72 174 85 .0500 79						
Conservation and Re-cycling Systems and techniques for the preservation or renovation of natural resources while serving the needs of production.	.0300 72 144 108 195 .0600 61 126 72 138 123 195						
Integrated Pest Management A unified, conservation-oriented approach to the control of animal and plant pests in agricultural applications, involving chemical, biological, and ecological methods.	.0100 2 60 10 .0200 2 184						

Area of Technological Growth and Development: AGRICULTURAL TECHNOLOGIES

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Animal Production Systems and techniques for animal husbandry, including environmental control, automated feeding or milking systems, etc.	.0100 21 180 126 195 138						
Agricultural Equipment/Machinery Innovations in agricultural machinery and equipment of various types.	.0300 5 143 21 147 72						
Planting Methods Innovations in techniques for field crop propagation.	.0100 13 71 51 72 55 195 .0300 147						
Aquaculture Methods and systems for the productive cultivation of edible flora and fauna which live in fresh or salt waters.	.0600 153 199 195						

Area of Technological Growth and Development: BIOMEDICAL TECHNOLOGIES

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Diagnostic Imaging Noninvasive instruments, instrument systems, and techniques for display visual analogof biological subsystems of living animals and humans. Includes such methods as radiology (X-ray), ultrasound, computed tomography, and nuclear magnetic resonance.			.0300 73 115 75 .0500 75 .0900 69 75 73 115				
Physiological Monitoring Invasive and noninvasive instruments, devices, and control systems for monitoring or displaying physiological functions in living animals and humans.			.0300 157 165 160 .0900 165			.0300 97 165 160	
Controlled Infusion Devices and controls for precise delivery of liquids, such as drug or nutritive solutions, intravenously to living animals and humans.			.0300 90 160 157 165 .0600 136 .0900 165			.0300 160 165	

Area of Technological Growth and Development: **MANUFACTURING**

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Machining Tools and techniques for the manufacture of machine parts and other objects. Includes devices and methods for cutting, turning, drilling, grinding, milling, finishing, forming, testing and inspection, etc.							.2302 140 .2306 67 192 78 193 167 194 .2307 140
Welding, Cutting and Related Tasks Methods and devices for welding, cutting and other metalworking processes. Includes also other spot-heating applications such as annealing and etching, which may make use of high-power lasers.							.2305 167 .2306 3 67 36 167 45 185 52 .2399 68
Automotive Technologies Materials, components and systems in the manufacture of automotive vehicles, especially cars.						.0104 45 201 104 202 183 .0108 45 183	

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Area of Technological Growth and Development: ORGANIZATIONAL/SOCIAL TECHNOLOGIES

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Health Care Delivery Systems Planned organizational structures and systems for, the provision of health care.			.0200 8 166 74 .0300 39 166 76 .0400 39 74 .0904 39 166 .9900 65				
Retail Marketing Innovations Planned organizational structures and systems for the distribution of products or services.		.0600 24 .0800 24 132 46 145 124 .9900 25					

Area of Technological Growth and Development: ORGANIZATIONAL/SOCIAL TECHNOLOGIES

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Work Scheduling Planned organizational structures and systems for the reconstruction of hours and places of work, such as job-sharing, "flexitime," and work at home, in satellite office centers or other locations.					.0600 4 178 84 181		
Worker Participation in Management Organizational structures and functions involving workers in efforts to improve production or product quality, such as Quality Control Circles, Quality of Work Life Groups, and methods of organization development.					.0600 17 134 130 139		

Area of Technological Growth and Development: OTHER TECHNOLOGICAL IMPACT AREAS

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Alternative Energy Generation Innovations in or re-emphasis on methods and sources for the production of usable energy, such as solar, power and, biomass conversion.	.0100 88 .0300 3 72 .0400 54 116 72 195 94 .0600 72					.0104 148 .9900 107	
Household Appliances New classes of appliances, improvements in appliance products, or innovative uses for appliances.	.0400 86	.1000 86 179 100 187 177		.0104 86 177 100 187 .0107 86 179 .0204 86 177 100 187			.0200 100 177
Chemical Separation and Analysis Instruments, devices and methods for filtration, purification, or qualitative or quantitative analysis of chemical mixtures in batch or continuous processing.	.0400 200					.9900 22 182 93 200	.9900 22 122 93

APPENDIX B

Annotated Bibliography

1 A technology forecast for 1981. Telephone Engineer and Management, 1981, 85 (2), 80-81.

Discusses videotex (teletext and viewdata) systems developed for the home market, in terms of their spread into use by business subscribers.

2 Allen, G.E., and Bath, J.E. The conceptual and institutional aspects of integrated pest management. BioScience, 1980, 30, 658-664.

Describes integrated pest management (IPM), an alternative to simple chemical pest control. IPM is a framework for the modification of basic pest control systems by incorporating less energy-intensive, more environmentally safe methods, and capitalizing on various technologies and delivery systems.

3 Allen, K. Windpower returns to the farm. The Furrow, March 1979, 84 (3), 3-5.

This article discusses new ways to harness wind power, new types of windmill configurations, and ways to use wind power on the farm. Descriptions are given of: air-lift water pump; vertical windmill (lift on blades like aircraft wing) may be more cost-effective than conventional windmill; turbine linked to farmers electric utility line; multi-bladed wheel windmill. Uses of wind power: on dairy farms--auxiliary electrical power used to heat water and chill water, Cornell experiment--agitates water in an airtight container--increases water temperature; for pumping water for irrigation.

Future: Wind energy probably will never provide a major part of the total U.S. energy requirement. However, it almost surely will become a significant source of energy for smaller utilities, rural homes and agricultural areas.

4 Alternate work patterns. The Personnel Administrator, October 1979, 24 (10), 19-85 (Entire issue).

The entire issue focuses on alternate work patterns. Articles include:
19 Alternative work schedules: the state of the art
25 Trends in the development of alternative work patterns
29 A work schedule to increase productivity
35 Job sharing: an answer to productivity problems
40 Alternative work policies in private firms
45 Pair potpourri
51 Flexitime's potential for management
59 Why executives change jobs

67 Union attitudes and the "manager of the future"
75 Human resource perspectives for the 80's
85 What's New

5 Anson, J. H. Electronics in agriculture--electronic instrumentation: A brief review. Agricultural Review, September 1981, 62 (9), 8-9.

Brief history of development of "the age of agricultural electronics" (beginning in the late 1960's) and current applications of electronic monitors and controls for higher productivity in agriculture--includes operator benefits.

6 Arney, T.O. Goals, components, constraints--control systems. Instrumentation in the Mining and Metallurgy Industries, 1980, 7, 135-149.

Describes components and concepts in industrial process control systems architecture. CRT-based operator interface consoles are described. Trends noted include the increase of database management functions within the process control system.

7 ATM (Automated Teller Machines). Business: North Carolina, December 1981, 1(3), 27-31.

Survey of the state-of-the-art of automated teller machines in N.C. and projections for future expansion and improvements. Reports reactions of users, problems and benefits.

8 Bamberg, R. Educating clinical laboratory scientists in the 1980s: Some suggestions. American Journal of Medical Technology, 1981, 47, 259-261.

Describes the continuing shift toward more diffusion of laboratory functions away from the large hospital or private laboratory to smaller health care centers, with resulting need for more generalist lab technicians working within a health care team.

9 Bell System's No. 5 ESS. Telephony, 1981, 201 (14), 20-26.

This collection of four brief articles describes electronic switching systems (ESS) already in place, and notes ESS as a major breakthrough in modern communications, as they can replace outmoded electromechanical systems. Operator interfaces with the control system are treated. Hardware and system architecture are also covered.

Conserva. Inc.

10 Berg, G.L. IPM: fact and fallacy. American Vegetable Grower, March 1981, p. 12.

Integrated Pest Management was developed in heal the breach between the chemical entomologist and the biological entomologist for the control of pests: (1) offered reduced use of chemicals; (2) improved public attitude toward control and (3) EPA could support IPM and be positive about it.

Dr. Perry Adkisson of Texas A&M Research Foundation head of CIPM-Consortium for Integrated Pest Management. Growers themselves are sparking crop management. ICPM-Integrated Crop and Pest Management came about as the result of a ground swell of growers demanding professional services of all types. And pest management is one of them.

11 Binkley, D.P., and Major, H.W. A complete system for distributed processing and laboratory data management. American Laboratory, 1981, 13 (9), 66-76.

Laboratories can often be semi-automated for efficiency through distributed processing (i.e., networking different databases), and the architecture of one such system is described. Probable users and user functions of such systems are given.

12 Binstock, M.H. Using advanced control to improve power plant performance. InTech, 1980, 27 (1), 45-48.

Describes the use of advanced control technology in the integration of functions and hence performance improvement in power plants. Valve programming, bypass systems, and pressure controls are among the functions in a sophisticated integrated system.

13 Block, J.R. Research, production, marketing--fine tuning the machine. Seedsmen's Digest, August 1981, pp. 26-27.

The administration considers long-term export growth as something that is very crucial to the agricultural economy, and to the entire nation's economic health. Secondly, the area of research is considered as one of the most critical in our challenge of long-term productivity.

Agriculture is the largest net contributor to our balance of trade payments with a surplus reaching toward $30 billion. Some new developments include: a new tillage and planting system called "slit-planting" wherein a vertical slit 15 inches deep acts as a channel for plant roots. Genetic engineering has developed a vaccine effective against foot and mouth disease and promises many more profitable plant variations in the future.

14 Brancatelli, J. Office of the future--The people factor. Review (United Airlines), October 1981.

The office of the future is in fact a perpetual electronics revolution and the business community and its consultants now do agree that it is integral to improved worker productivity and growth. The office of the future entails a highly automated office environment that performs most clerical chores electronically and encourages dramatic improvement in the productivity of managerial and professional personnel.

15 Brosilow, R. and Weymueller, C.R. Robot welding starts to catch on. Welding Design and Fabrication, November 1980, pp. 184-204.

The time has come for robotic welding. Owing to advances in microprocessors and integrated circuitry during the last few years, computer controls for robot welding equipment have be come readily available at reasonable prices. Along with these drops in costs, hourly rates for welders keep rising making robot welding even more attractive.

In the U.S., the big push toward robot welding is in automative manufacture. Robots weld chassis and frames, spot weld floor pans, panels, bodies, door flanges and roofs. A small plant can use robots, too, now that they have controls that can be easily programmed to do a variety of jobs.

16 Brosilow, R. Automation--Robots...Are robots the answer? Welding Design and Fabrication, October 1981, 54 (10), 92-95.

Economists and social scientists call robots the immediate hope for the economic survival of this country. These machines, they say, are the tireless workers who will lift sagging U.S. productivity, put this country back in the running against foreign competition, and make it once more the light of world industry.

Top executives in industry use the number of robots as a rough gage of the state of sophistication of a plant. The robot represents technological advancement. Japan, by this scale, with its robot population 12,000, outdoes the United States' robot population, 3,000. These automated marvels are indeed doing wonders. They run entire die casting shops almost independent of human intervention; they assemble small and mid-sized engines and motors; they spot weld automobile bodies on the fly.

17 Bush, J.W. Putting punch in people participation. Ward's Auto World, October 1981, pp. 75-78.

Spurred by competition and new values, automakers tap labor's brainpower as never before--and no one knows where it'll lead. This article outlines the trend at American auto plants which are incorporating worker participation systems. Why? The answer in simple terms is survival. Quality of Work Life (QWL) programs mark a significant change in management-labor relationships, and more than 200 major U.S. companies are embracing the idea.

18 Business turning computers into electronic-mail systems. The Wall Street Journal, December 11, 1981, p. 29.

Announces growth and trends in the use of small computers for data telecommunication.

19 Bylinsky, G. A new industrial revolution is on the way. Fortune, October 5, 1981, 104 (7), 106-114.

With big computers or small, CAD/CAM is moving along. In the words of Joseph F. Engelberger, president of Unimation, Inc., the leading maker of industrial robots, "the word is out" that CAD/CAM is the wave of the future in manufacturing. CAD/CAM vendors and technicians repeat the refrain that "CAD/CAM has more potential to increase productivity than any other development since electricity."

20 CAM-I advances computer-aided manufacturing. High Technology, Industrial Technology, November/December 1981, 1 (2), 26-27.

CAM-I, Computer-Aided Manufacturing-International, a non-profit industry association based in Arlington, Texas, is promoting industry standardization for computer languages, data and techniques to enhance the use of CAM in industry. The organization currently sponsors six technical projects that focus on specific aspects of computer-aided manufacturing.

21 Cheatham, W.J. Technology in agricultural mechanization. The Agricultural Education Magazine, July 1980, 53 (1), 8-9.

Technological advances in mechanization of farm machinery and equipment and resulting changes in agricultural mechanics education are discussed. A listing is given of innovations, advances, changes: Tractor and Machinery Power--Larger, more efficient tractors. Planting and Care--Precision and accuracy in planting, cultivating and applying chemicals--(plateless planters; air planters). Harvesting Equipment--Gigantic capacity

harvesters, self-propelled combines, multiple row "corn head.". Crop Processing--High capacity processing machines. Livestock and Poultry Production -- Automation: electrically powered silo unloaders, automated milking parlors. Totally enclosed hog or poultry production systems.

22 Chemicals and petrochemicals: Advanced is today. InTech, 1980, 27 (2), 9-31.

Several illustrative examples are given of the use of microprocessors and larger computers for process control in chemical/petrochemical industries. On-stream analysis is mentioned as one particular developing technology.

23 Chemicals, energy to gain from gene splicing. Chemical and Engineering News, 1981, 59 (35), 10.

Indicates genetic engineering areas of application over a range of industrial sectors, and notes oil and chemical companies with major investments in the technology.

24 Cobe, P. The supermarket report. Forecast for Home Economics, March 1980, pp. 24-25, 46, 20.

There's a revolution happening in our supermarket aisles and it promises to have longlasting effects. Some supermarkets are now including delicatessens, bakeries, restaurants, houseware departments, clothing boutiques, florists, newsstands, gift shops, consumer information centers, and cooking schools. At the other extreme, box or warehouse stores offer generic brands and no frills.

25 Computer stores--Tantalizing opportunity selling computers to customers. Business Week, September 28, 1981, pp. 76-82.

Companies considered computer giants have turned to independent retailers to sell their new personal computers in addition to using their own sales forces and building chains of their own. They need new distribution channels to reach ever-broadening audiences with lower-priced machines.

But many industry officials are questioning whether the new breed of retailer can handle the boom. Few of the current 1,500 computer stores offer the support, service and expertise that customers will demand.

The article discusses the experiences of a crowd of competitive companies in the field, their areas of emphasis, difficulties,

and successes. A buyer's guide to personal computers is included and gives computer/price range; where to buy it; primary applications; and advantages/disadvantages.

26 Computers and manufacturing. Chilton's IRON AGE, Special advertising section, June 22, 1981, A2-A22.

Numerical control, more than any one development, has contributed to improving productivity, increasing efficiency, achieving quality in American industry. The fundamental reason for numerical control is to make machining more controllable.

The real excitement today is in CAD/CAM systems. Certainly they offer enormous payback. Increases in productivity of 3 to 1 are not unusual.

27 Computers in manufacturing--180 places you can turn for help. Production, December 1980, 86 (6), 48-81.

COMPUTERS: In U.S. Manufacturing plants today there is an installed base of computers minicomputers and terminals valued at more than $20 billon. NC/CNC: By 1990, it is predicted that 75 percent of the machine tools working in U.S. plants will be under CNC or direct numerical control. DNC: The overwhelming acceptance of CNC has triggered renewed interest in direct numerical control. PROGRAMMABLE CONTROLLERS: In 1981, U.S. demand for PCs will exceed $200 million. CAD/CAM: Today's $400 million CAD/CAM market will grow to from $1.5 to $1.8 billion by 1984. GRAPHICS: Opening the door to computer-aided manufacturing are interactive graphic systems tying computer-aided design to CAM. SOFTWARE: Software to support CNC, DNC and CAD/CAM systems is the big ticket item in computers in manufacturing. It accounts for 85 percent of expenditures.

28 Converging on a consensus--Hierarchial handling control. Production Engineering, August 1981, pp. 54-58.

Microprocessors have led to these key benefits for users: greater operating reliability in controls; quicker start-ups with easier last minute modifications; simpler maintenance via built-in diagnostics; replaceable modularized elements with more than one source for spares; cheaper, more efficient, less stressful movement of materials and machine parts; the ability to do more with equipment of higher order of automatic control; expandable, thus can work to longer-range strategic plan anticipating plant-wide integrated control handling.

29 Cornish, B.M. The smart machines of tomorrow--Implications for society. The Futurist, August 1981, pp. 5-13.

The impact of the microprocessor on society may be as great as that of the automobile or electric light--or greater. The applications of the new technology are seemingly limited only by imagination--not by cost or capability.

30 Cotton's electronic market. Data Processor, June 1979, 22 (3), 8-11.

Describes a system automating cotton trading and marketing in a large cotton exchange serving 24,000 producers.

31 Cromie, W. J. Robots: A growing, maturing population. SciOuest, March 1981, 54 (3), 12-16.

U.S., Western Europe, and Japan have built between 17,000 and 20,000 robots, most of which replace humans in factory jobs that are hard, dangerous or boring. They weld and paint auto and truck bodies, load and unload hot, heavy metal forms into machines that stamp or cast them into various shapes. They also do simple, monotonous assembly work on typewriters, watches, pocket calculators and various electronic devices. About 3,200 of them work in the U.S.

Robots are distinguishable from so-called automatic machines because they can switch jobs quickly. According to the Robot Institute of America, the most "talented" robots cost between $5 and $6 an hour to operate and maintain. An ordinary human on an assembly line, say in an automobile plant, earns about $17 an hour in wages and benefits.

32 DDP nets violators in Ohio. Data Management, January 1981, 19 (1), 2488-2400.

Describes a distributed data processing (DDP) system with over 1200 remote terminals serving the Ohio State Highway Patrol. Evaluation and training are covered.

33 Demand for man-aboard retrieval systems rises. Purchasing, 1981, 90 (10), 23-24.

Describes a "middle ground" approach (between simple forklift and completely automated handling) to internal materials stocking/transfer. Involves use of a manned unit which moves along a track in a large storage area and which elevates to high racks.

34 Dispersed DP pulls together care-giving services for retarded and handicapped. Data Management, January 1981, 19 (1), 24EE-24JJ.

Describes a distributed data processing (DDP) system serving area boards of education in Colorado with up-to-date administrative records information.

35 Dobson, P.J., and Olejar, J. Centel leaps into the future with fiber optic trunking. Telephone Engineer and Management, 1980, 84 (17), 60-62.

Of interest in this business article is a description of new splicing techniques for fiber optic cable, to be used by field service technicians.

36 Draper, C.W. Laser surface alloying: A bibliography. Applied Optics, 1981, 20, 3093-3095.

The use of lasers has been growing dramatically in surface alloying processes, which are used when an element is incorporated into a bulk alloy solely to affect the material's response to its immediate environment. References are provided to the technical literature.

37 Dymmel, M.D. Reacting to new technology: The communications industry. VocEd, January/February 1982, 57 (1), 41-43.

Technological change has already been felt strongly by the communications industry and its workers. Both traditional telephone communications and nontraditional communications (including interconnect, data, video, residential and commercial security alarm services, "office of the future" equipment and others) have changed and expanded dramatically. The computer plays an ever more important role in the determination of job skills required or no longer required by the communications industry as technology advances. The availability of a skilled workforce will be critical in the 1980s. The total information industry by 1990 will open 1.4 million new jobs. Community college technical programs, military skills training, vocational-technical schools, specific skills training programs and apprenticeship training will be called upon to fill the need.

38 Early look finds robots shifting 444,000 workers in the 1980's. American Metal Market, October 12, 1981, p. 12.

Research findings are overviewed concerning the spread of robotics in industry and resulting effects on employment within current job classes.

39 Eckenhoff, E.A., Hamilton, B.B., and Watkins, R.A. Medical rehabilitation in the 1980s. Health Care Management Review, Spring 1981, 55-62.

Discusses trends in demand for and organization of rehabilitative services. New offices for nurse, physical therapist, and physician assistant roles are expected, resulting from diffusion of services into physicians' office practices and private practice of allied health professionals.

40 Edson, L. Slaves of industry. Across the Board: The Conference Board Magazine, July/August 1981, XVIII (7), 5-11.

Some 3,200 robots have already joined the assembly lines of U.S. manufacturing plants -- spotwelding, spray-painting, transferring glass from one part of assembly line to another. They mine coal, spray crops and remove rivets from damaged aircraft. In Australia, they shear sheep. "By the end of the decade we expect to count some 20,000 robots in American industry doing many different things," says Lori Mei, spokeswoman for the Robot Institute of America, the Detroit-based trade association of robot users and manufacturers. "And," she adds, "we anticipate a $2 billion-a-year business, up 3,000 percent from today."

41 Electronic component testing with ATE (Automatic Test Equipment) Part I. Quality-For Better Product Assurance and Reliability, October 1980, 20(10), 16-17.

An overview of high-volume incoming testing techniques and equipment. The power of ATE comes from its microprocessor and computer control, and from the ability of the user to access that power through essentially human language commands.

42 Facsimile market to boom as offices seek high productivity. Marketing News, April 3, 1981, 14 (20), 11.

Reports product usage trends predicted to occur during the 1980's in facimile and facsimile telecommunication. Focuses productivity.

43 Feidelman, L. Understanding personal computers and their uses. The Office, October 1981, pp. 107-108.

Discusses rapidly increasing use of personal/business computers by businesses; importance of good application programs and user support by vendor; also, importance of training of company personnel in computer operation.

44 Fibre optics heads for the bright lights. New Scientist, July 9, 1981, p. 89.

Economists at Stanford University in California and engineers in Japan have teamed up to devise a replacement for the neon sign. The novel design, which is based on thousands of short lengths of optical fibers, costs about 20 percent more than a neon display to construct, but is cuts energy consumption by between 40 and 80 percent and lasts twice as long between services, say the designers. The new system, called IMTECH, has only a small number of light sources and is weatherproof. It combines the versatility of bulb displays with the color of neon or argon displays.

45 Fleming, A. 1980s--Car of the next decade faces a different world. Ward's Auto World, January 1980, pp. 33-40.

In the 1980s, we will see electronic and computerized gadgetry like never before; exotic construction and materials; small, efficient vehicles; and new ways of producing them. There will be increased use of electronic controls, 2/3 will be compact or smaller in 1989 and 75% will be front-wheel drive. A principal change will be substitution of plastics and aluminum where possible for conventional steel and iron. High-strength, low-alloy steel (HSLA) steel will also be more widely used. On-board diagnostic aids, electronic entertainment and drive information systems and other computer-based features are planned.

46 Focus on technology in the retail marketplace. Retail Technology, July 1981, pp. 4-44.

Electronic equipment is becoming a vital force in all facets of the retailing industry: electronic point-of-sale cash registers; computers; communication systems; universal product numbering; computerized or automated warehousing; word processing; facsimile systems; lighting, fire detection, and security systems; and OCR systems.

47 Fraade, D.J. Applying computers in multipurpose batch processing plants. InTech, 1980, 27 (12), 34-39.

Treats computer applications in multipurpose batch processing applications. Sensors, controllers, and other areas of development, as well as centralized vs. distributed systems, are discussed. Personnel training, including required skills, is also covered.

48 Fraade, D.J. Some user aspects of computer control of batch reactors. Instrumentation in the Chemical and Petrolum Industries, 1980, 16, 75-94.

In addition to describing the architecture and application of digitally controlled batch chemical process systems, a training program is described which includes familiarization with computer interaction. The demands on workers' skills are noted.

49 Froehlich, L. Robots to the rescue? Datamation, January 1981, 85-96.

Discussion of types of robots and what they can do; productivity factors; progress in robot ability; growth of the Industry; and effects on the work force.

50 Gagle, M., Koehler, G.J., and Whinston, A. Database management systems: Powerful newcomers to microcomputers. Byte, November 1981, 6 (11) 97.

Computers for small companies can be programmed to support a database management system (DBMS) replacing multiple data files.

51 Gerber, J. Direct seeding tomatoes: the future is here. American Vegetable Grower, December 1981, pp. 6-7.

Discussion of field seeding of tomatoes as an alternative method of stand establishment for processing tomatoes. Many midwest growers are using direct seeding rather than southern-grown transplants. Irrigation, raised beds, improved planting methods, better herbicides, and more uniform, earlier varieties will allow growers to nearly automate tomato production for mechanical harvest.

52 Gibson, G.T. Lasers give job shops a high-tech future. Venture, January 1982, pp. 60-61.

The laser job shop is dramatic proof that an old-fashioned industry can receive new life by adding new technology. The laser is emerging as the centerpiece of new laser job shops all around the country. They are used to heat-treat, inscribe serial numbers, cut and weld. Unlike traditional machine tools, lasers never dull and can perform in seconds tasks that can take hours for old- fashioned machines. (author)

53 Green, A. M. Captive NC builders see more systems in their future. Chilton's Iron Age, April 27, 1981, 224, 51-54.

Numerically controlled machine tools hold a pivotal position in the resurgence of American industry. Together with robots, materials handling devices and limited manpower, they will form manufacturing cells to increase productive efficiency. Systems, automation and unmanned systems are logical replacements for people--first in hostile environments, then in the second and third production shifts.

54 Grey, J. Future energy alternatives. AIAA Student Journal, Summer 1979, pp. 28-31.

Many of the so-called "new technologies" of solar and other "nonconventional" energy sources are not really new at all. The changing economies of world energy have brought them back as serious energy supply options. Solar, biomass, wind energy, waves and tides, water power and geothermal sources of energy --all hold varied degrees of promise for the future, but it is not likely that any of them will make substantial contributions soon.

55 Grimshaw, P.J. Fluid drilling: a British perspective. American Vegetable Grower, December 1981, pp. 9-12.

Fluid drilling is a British-developed planting system which sows germinated rather than dry, ungerminated seed. This article gives a description of the process including: preparation of seed--soaking, mixing with gel carrier, method of planting, and growth results compared with dry seeding. Benefits with specific crops: tomatoes, celery, container-grown crops and trees, carrots. There are so many advantages that fluid drilling seems certain to become accepted as a normal method of crop establishment.

56 Groxell, W., Holcomb, E. and Bergman, E. Hydroponics: not just a pipe dream. American Vegetable Grower, February 1981, p. 28.

This article describes testing of the Skaife Pipe Dream hydroponic system for growing vegetables. A discussion is presented of the use of different growing media on growth and germination of cucumber seedlings: (1) Anything Growes Peat, plants grew larger; (2) Commercial Peat; (3) Vermiculite, plants grew larger; (4) Fine Pumice and (5) Coarse Pumice. Osmocote 14-14-14 fertilizer was used (slow release). The process is simple enough that homemakers can easily grow crops.

In a preliminary trial at Penn State, tomatoes growing in the Skaife Pipe Dream were as productive or more productive than plants growing in a traditional gravel culture system.

57 Haavind, R. Future looks bright for guided wave optics. High Technology, November/December 1981, 1 (2), 35-43.

By the end of this decade, the flow of data, video, electronic mail, telephone conversations, and teleconferencing will increase manyfold. Available transmission facilities such as satellites for both domestic and overseas traffic could become overloaded in the near future. A new kind of communications link with huge capacity and the ability to go for 35 to possibly 100 kilometers without repeater stations is causing excitement at communications research laboratories around the word. Recent rapid advances in a number of world critical research areas make monomode fiber optic lightguides very promising for the future. Their enormous capacity and their potential for carrying data very long distances with little distortion have long been recognized, but advances in processes to make the extremely minute monomode fibers have recently been made.

58 Haramaki, C. and Heuser, C. Plant propagation--The future is here. American Horticulturist, August/September 1980, pp. 24, 40-41.

Reasons for producing plants through micropropagation include: (1) production and maintenance of sources of disease-free plants; (2) to rapidly multiply plants which are normally slow to propagate by conventional methods; (3) to conserve space. With the advances now being made, tissue culture of plants has become one of the most significant developments in the history of plant propagation. The increasing number of new plants which can be tissue cultured, the new techniques and the better understanding of the biological processes involved are rapidly changing the methods of plant propagation used in the nursery industry.

59 Harris, E.E. The face of the future--Marketing. VocEd, January/February 1982, pp. 37, 82.

At present, 1/3 of the work force is employed in marketing, and without retraining to keep up with technology, today's marketing employee will be obsolete by 1990. It is predicted that 20% of all retail sales will be done by videotex systems by 1990. Penney's and Sears are presently testing electronic catalogs. Videotex is also being tested for news, weather and other communication services, banking and stockbroking. Electronic automated management systems and the Universal Product Code are already in use and will have an increasing impact on retailing. Marketing employees will have to be taught how to use the new technologies while still being responsive to the needs of customers.

60 Hartstack, A.W. Insect modeling. Agricultural Engineering, September 1981, 62 (9), 19-20.

How the integrated pest management (IPM) concept of pest control is enhanced with the use of systems analysis and computer models.

61 Harvey, J. It's time to join the less-till age. Farm Journal, April 1980, 104 (7), 13-15.

Conservation: Loss of topsoil is reaching crisis proportions. Conservation tillage, minimum tillage, zero-till, no-till and low-till are some terms encompassed in the "Low-Till Age."

U.S. farmers and ranchers must come to grips with soil loss -- many have already. Soil losses today are greater than during the Dust Bowl days of the dirty '30s.

62 Hatvany, J., and Janos, J. Software products for manufacturing design and control. Proceedings of the IEEE, 1980, 68, 1050-1053.

Software problems constraining the growth of CAD/CAM technology are reviewed. Directions the industry may take are offered.

63 Hayer, D. Computers take to the field. The Furrow, July/August 1979, 84(6), 22.

"Smart boxes" called Blitecasters recommend whether growers should spray for late blight, a fungus disease. Through sensors which measure temperature, humidity and rainfall in the field, then analyze the data, the computer predicts the likelihood of a late blight outbreak.

64 Heating up productivity with handling systems. Production Engineering, September 1981, pp. 66-69.

The typical up-to-date plant producing discrete parts contains a number of islands of mechanization and automation embedded in a sea of older techniques. Advances in three areas are paving the way toward problem solutions. One area involves simulation and CAD/CAM; another area is based on advances in microprocessor technology; and the third, an emphasis on flexibility involving robots.

65 Heating up productivity with innovative inspection methods. Production Engineering, September 1981, pp. 74-77.

The guidepost for the new American industrial Gold Rush is quoted as: "Quality doesn't cost. It pays for itself." Quality control is involving minicomputer-based systems which save tremendously on time, effort and dollars. Electronic readouts on welding machines catch faults as welds are being made. Future test and inspection hardware will be integrated into the machine or line that it serves.

66 Hegland, D.E. CAD/CAM integration--Key to the automatic factory. Production Engineering, August 1981, pp. 31-35.

CAD systems include automated drafting, geometric modeling, engineering analysis, and kinematics, with all the functions interfaced in many cases. CAM systems include numerical control, robotics, process planning, and factory management, but typically as stand alone systems. Integrating the two disciplines via a common data base is probably the major task facing CAD/CAM vendors and users in the near future. Thus far, the only CAM function that has been linked with CAD is NC tape generation; the other CAM functions still stand alone, for the most part.

67 Hegland, D.E. Heating up productivity with nontraditional processing. Production Engineering, September 1981, 28 (9), 50-53.

Lasers, ultrasound spark erosion and high speed jets of abrasives or tap water each can solve specific problems in manufacturing. The laser is probably the most versatile of all the nontraditional machining tools. It cuts and drills virtually any material--hard or soft, brittle or ductile, insulator or conductor. Electrical discharge machining removes material from the workpiece with continuous spark discharges between the workpiece and a shaped tool. Ultrasonic machining erodes the workpiece by the action of an abrasive vibrating at ultrasonic frequency. Abrasive jet machining can be an ideal answer for micromachining of hard, brittle or heat sensitive materials. Water-jet machining removes material with a high velocity stream of water.

68 Heidary, H.R., Begley, D.L., and Corner, L.D. Microprocessor-controlled laser scanning system for annealing of semiconductors. Optics and Laser Technology, 1981, 13, 265-269.

Describes a recently developed technique with applications to the manufacture of semiconductors, incorporating digital control and laser technology.

69 Henderson, B.J. Diagnostic imaging: Developing new roles. CMA Journal, 1981, 124, 314-320.

Describes briefly several diagnostic imaging technologies, including ultrasound, nuclear magnetic resonance, and tomography methods. While concerned primarily with new roles for physician specialists, the need for clarity in allied health is also touched on.

70 Henkes, R. Computers come to the farm. The Furrow, May/June 1979, 84(5), 2-5.

Article provides a description of some of the many uses to which computers have been or can be put by farmers. Balancing books; planning crop rotations; fighting pests; scheduling workdays/field operations; controlling light, temperature and humidity in farm buildings; operating sprinkler system automatically; running food processing equipment.

Sharing of information via computer terminal such as through Project "Green Thumb" sponsored by the Federal Extension Service, the U.S. Weather Service and the University of Kentucky, includes county weather forecasts, market reports and analyses and information on fast-changing technical matters such as the disease and insect situation in crops.

Access to data bases could be an issue of the future.

71 Hexagons, computer models hold promise for small farms. Seedsmen's Digest, January 1981, pp. 46-47.

The hexagon is, in some ways, the shape of things to come for small farms around the world. Hexagonal plantings are being used at Michigan State University's Agricultural Experiment Station as a means to gather information about growing systems of crops raised simultaneously in shared, limited space. All information essential to growing the crops (weather--sunlight, temperature and rain, and nutrients and soil moisture) is fed into a computer and different combinations of variables are then programmed to find which conditions will produce the best harvest and predicting yields. This technique of computer modeling or simulation of growing systems will provide a new and speedy method to generate specific and detailed information on how to produce maximum harvest in virtually any crop. Literally years of field trials may no longer be necessary.

72 Hill, D.A. The face of the future--Agriculture. VocEd, January/February 1982, 57 (1) pp. 35, 83.

Farms of the future will be transformed by advanced mechanization, telecommunications, energy conservation and genetic plant research. Larger, lighter, more powerful equipment will reduce fuel consumption, will be self-steering and self-adjusting and safer to operate. Computers will be involved as controllers, monitors, sensors, business aids, information links and in numerous other ways aid efficient farm practices. Natural resources such as sun, wind and farm by-products will be used to generate energy. Emphasis on conservation of soil and water will involve equipment changes, irrigation and tillage practices, new production techniques and re-cycling of waste water and by-products of farming. Genetic engineering of plants will bring new, more nutritious crops.

73 Histand, M.B., Corace, R.A., and Wells, M.K. Ultrasound doppler and echo combined as a noninvasive blood flowmeter. Biomedical Sciences Instrumentation, 1981, 17, 73-78.

Asserts that ultrasound methods will be increasingly important in clinical diagnostics throughout the 1980s. One system's structure and application is described.

74 Holder, L. Allied health perspectives in the 1980's. Journal of Allied Health, February 1981, 10 (1), 5-14.

Article summarizes changes in technology, population characteristics, disease patterns, etc., affecting the health care delivery system and influencing allied health education and practice. Trends in allied health in the United States are discussed. Analysis of "allied health" professions is offered.

75 Holman, B.L. Diagnostic imaging: A medical discipline for the 1980's. Medical Instrumentation, 1981, 15, 25-26.

The medical field of "diagnostic imaging" is defined, and developments in component fields (including traditional radiography, ultrasound, computed tomography, nuclear magnetic resonance, and others) are highlighted.

76 Homemaker--home health care aide--the caring alternative. Forecast for Home Economics, September 1980, p. 126.

The career of Homemaker-Home Health Care Aide is becoming more and more important in our society. People are living longer and many older Americans want to live out their lives in their own homes rather than in a nursing home or a home for the aged. Home Health Care Aides help to make this possible.

This article is a description of the job of Homemaker-Home Health Care Aide including requirements, training, opportunities and benefits.

77 Huber, R. F. Tell it to your machines. Production, June 1980 pp. 102-104

Voice input or voice-aided programming is now being used in the metal-working industries generally serving one of two functions: As a programming method for numerical control and as a data input method for manufacturing information systems. On NC or CNC programming, major advantages include the fact that the programmer does not need to be an expert at keyboarding; he can use his voice to take data directly from the blueprint and enter it into the program. Voice programming for numerical control (VNC) allows factory personnel using normal English words to speak commands needed for parts programming.

78 Huber, R.F. The world of productive ideas. Production, August 1980, pp. 96-183.

Machining Centers--more modularity in NC controls; trend toward tighter structures and higher spindle speeds. Turning--more slant bed design, integral NC; automatic loading. Milling--faster machining cycles for metal removal; new NC systems using microprocessors. Drilling and Boring--automatic tool-changing devices; machines are simpler, therefore easier to maintain; latest control systems. Grinding--Solid-state controls, such as programmable controllers and proprietary logic circuitry and CNC with microprocessors; remote machine diagnostics, plug-in replacements of electronic components. Forming--CNC, lower noise levels, higher powered lasers and plasma cutting features. Controls--computer technology (computer numerical control systems; direct numerical control systems and bubble memory); CAD and CAM with interactive computer graphics.

79 Hutton, R. Predictions for the '80s. American Nurseryman, April 15, 1980, pp. 11, 58-63.

Production changes will be necessary in the 80's. Some changes will relate to energy use, efficiency in using pesticides, herbicides, plant nutrients and growing media. New kinds and types of plants will become available and will be used increasingly for traffic control, crowd control, security, energy saver, sound barriers and dust and dirt filters. The industry will utilize computer technology for information, business management and production.

Conserva. Inc.

80 Impacts of applied genetics: Micro-organisms, plants, and animals. Washington, DC: U.S. Congress, Office of Technology Assessment, 1981. (Note: See summary articles in BioScience, March 1981, p. 198, and June 1981, p. 426).

According to OTA, genetic technologies may help fulfill some basic needs. The report describes technologies now operating or in development in such applications as chemical processing, food processing, plant breeding, and energy.

81 Information Executive's Report. Data Management, May 1979, 17 (5), 28-56.

A collection of twelve brief articles on office technology and automation, covering such topics as microform, word processing, facimile processes, and data processing.

82 Irving, R.R. Fiber optics helps control critical welding operations. Chilton's Iron Age, October 14, 1981, 224 (29), 83.

Picture an extremely inaccessible welding location where a critical weld had to be made. The tolerances of the weld were exceptionally demanding, but its location was nearly beyond the reach of conventional welding equipment, and well beyond visual inspection range.

This complex welding problem was resolved with the fiber optic welding monitor from American Optical, Scientific Instrument Division, Southbridge, MA. Unaffected by the 250°F temperature and immune to electromagnetic interference, this equipment's flexible, small diameter fiber optics image cable transmitted a clear picture of the weld to an observe stationed outside the sphere, allowing him to make critical adjustments as the welding operation progressed.

83 Irwin, R.D. Get the most from computerized steel-collar workers. Production Engineering, August 1981, pp. 46-50.

Article condensed from a paper presented at the second annual Wood-Compton Forum, Cleveland, September 1980. Robots have a common mission--extend the efforts or capabilities of humans. Description given of types of robots -- (1) Pick and place; (2) Servo style. Discussion of costs and capabilities of each type. How many robots are now in use? Estimate given--depends on definitions. Information presented on robot safety.

84 Jacobs, B.A. Humanizing the electronic office. Industry Week, September 21, 1981, pp. 85-88.

A desire to boost productivity and conserve energy has increased companies' interest in providing employees with flexible

working hours and work sites. Modern technology makes the changes possible. The introduction of interconnect technologies creates new organizational styles and patterns that have only just begun to be explored, i.e. at-home organization and equipment must also be carefully planned to take physical and psychological human factors into account. The success of the electronic office will depend on how employees in it are managed.

85 Jacobs, L.D. Hydroponic vegetable growing conserves space, energy. Food Development, July 1981, pp. 12-13, 16, 18.

This article contains a description of the procedure for growing vegetables hydroponically and a discussion of companies/research units involved in the process, including the demonstration project being set up at Disney's EPCOT (Experimental Production Company of Tomorrow) by the University of Arizona's Environmental Research Laboratory, Kraft Corp. and the Disney Corporation.

86 Jenks, M. E. Microwaves--The wave of the present. In Microwave ovens--what's cooking? (Proceedings of the National Technical Conference of College Educators in Home Economics). Chicago: Association of Home Appliance Manufacturers, 1978, pp. 12-16.

Overviews market penetration statistics for microwave ovens. Provides guidelines to industry for the development of maximally effective products in three areas: food products specifically for microwave ovens; packaging specifically for microwave reconstitution; and microwave cooking instructions on dry grocery and frozen food product labels. Describes problems with lack of standardization of ovens, and gives examples of recipe conversion.

87 Jones, R.B. Industrial application of programmable logic controller. Instrumentation in the Chemical and Petroleum Industries, 1979, 15, 83-89.

The operations of maintenance technicians are briefly mentioned in this overview of programmable controllers (PC) in chemical production plants.

88 Kaneff, S. Alternative sources of energy for farming. The Agricultural Technologist Journal, August 1979, 10 (3), 4-12.

Solar energy applications to agricultural needs are discussed. Need for changes in agricultural methods and options for action are pointed out. Table I: Lists applications of solar energy being developed for agricultural activities.

89 Kao, C. Fiber optics--Worldwide. Telephone Engineer and Management, 1980, 84 (17), 43-46.

Presents an expert's perspective on the state-of-the-art and future trends in fiber optics usage in the telecommunications industry.

90 Karapita, A.T. Intravenous therapy: Past, present, and future. Dimensions in Health Service, March 1980, 57 (5), 20-23.

Briefly mentions home health care and microprocessor-based monitoring/control as developments which will influence intravenous therapy in the years ahead.

91 Karl, L.J., and Jones, D.J. Microprocessors: DDC for large electric utility boilers. InTech, 1980, 27 (7), 47-49.

Describes the advantages of direct digital control for electric utility boilers, with special attention to distributed processing (central control of a number of separate microprocessor-controlled process loops).

92 Keenan, R. L., Mount, B. E., Persinger, G., and Melnyk, J. A computer-controlled semi-automated system for processing human blood to produce chromosome slides. Biomedical Sciences Instrumentation 1980, 16, 117-122.

An automated system for blood specimen analysis is described, wherein operators must select command modes and intervene in cases of hardware malfunction.

93 Kehoe, T.J. A futuristic look at on-line analytical instrumentation techniques in the 1980's. Analysis Instrumentation, 1979, 17, 1-6.

Discusses history and developing trends of on-line analysis instrumentation. (On-line analyzers are used in continuous chemical production processes to determine the constituency of a fluid stream.) Includes qualitative projections.

94 Kessler, K. Bad plants go straight. The Furrow, Southeast Edition, March 1981, 86 (3), 12-15.

New Crops? Weeds farmers have battled for years may become crops of the future. Some researchers and farmers are finding ways to use weeds rather than kill them. Medicine thistle (called blessed milk thistle) contains an extract in its seed that can be used in a medicine for cirrhosis of the liver. (This hated weed may become a major money crop for some Texas farmers.) Hydrocarbon plants--Scientists are interested in some that produce latex--virtually identical to crude oil: (1) 34 out of 300 weeds and other wild plants tested have good potential for commercial use such as, (a) gopherweed and (b) milkweed--also has other useful by-products such as seed down and stem fibers and high-protein residues that could be used in animal feed.

95 Kessler, K. It's not nice to fool with mother nature...or is it? The Furrow, April 1979, 84 (4), 2-5.

This article gives descriptions of procedures including nitrogen-fixation research, photosynthesis, recombinant DNA, tissue culture, test tube chickens, cell fusion and cell-free agriculture. Benefits and implications for filling needs of the future are discussed. "If future generations are to feed themselves, scientists will have to learn many more of nature's perplexing ways and figure out how to improve on them." (author)

96 Kinnucan, P. Local networks battle for billion-dollar market. High Technology, Nov/Dec 1981, 1(2), 64-72.

A revolution is brewing in computer communications. A new technology, local area networks, links computer gear located within a geographically restricted area, such as a building or an office complex. The spread of low-cost computers into the office, laboratory and factory is rapidly creating a billion-dollar market for specialized communications equipment.

97 Knutti, J.W., Allen, H.V., and Meindl, J.D. Integrated circuit implantable systems. Biomedical Sciences Instrumentation, 1979, 15, 105-112.

Describes basic components and logical structure of totally implantable telemetry systems. These systems are used primarily in research with free-roaming animals, but have applications in drug and toxicological research as well. They have been used to measure physiological parameters such as deep-body blood flow, dimension, pressure and bioelectrical data.

98 Kulkosky, E. CAD/CAM: The new computer wonder. Financial World, July 1, 1979, pp. 12-15.

In its simplest form a CAD/CAM system consists of a minicomputer, a keyboard, a monitor screen, a tablet and light pen, and a computer program. The user can draw an outline of a simple part such as a gear on the screen; add depth automatically to produce a three dimensional version at any desired angle; generate front, side and top views; rotate the part; produce a mirror image; and otherwise manipulate the drawing in just about any way he wishes.

99 Kulwiec, R.A. Materials handling in the future. National Safety News, 1981, 124 (5), 34-27 (book review).

Computerized control systems in storing and retrieving operations are described. Robotics is mentioned.

100 Layton, W. C. Product service: A return to the offense. In New demands--New directions (Proceedings of the 29th National Home Appliance Conference). Chicago: Association of Home Appliance Manufacturers, 1978, pp. 78-79.

Discussing service technicians' interaction with new consumer appliances, points out efforts at accreditation of repair personnel and the systematic use of repair personnel input in the design of new items.

101 Legana, T., Jr. Digital control system user interfaces; The same but different. InTech, 1981, 28 (11), 55-57.

Many options and choices are available for operator interfaces to digital control systems. Article overviews various display and control panel monitor, command, alarm, and recording systems which present different configurations to operators.

102 Lerner, E.J. Computer-aided manufacturing. IEEE Spectrum, November 1981, pp. 34-39.

The metalworking industries that produce medium-sized batches are likely candidates for CAM. In traditional nonautomated metalworking, each machine is actually cutting metal only about five percent of the time, whereas in automated systems metal cutting may approach 70 to 100 percent of the available time, leading from tenfold to twentyfold increases in tool production.

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103 Lewis, J.W. Commentary: Clinical laboratory information systems. Proceedings of the IEEE, 1979, 67, 1299-1300.

Overviews of growth of and challenges to computerization in clinical laboratories for analytical instrumentation control as well as for data aquisition and management.

104 Lightweight plastic "composites" are rivaling aluminum and steel. The Wall Street Journal, January 23, 1981, p. 29.

Describes the emergence and growth of lightweight plastic composites which can replace metals in certain machine parts, especially in automobiles' structural parts.

105 Lippman, Thomas W. The reprogrammable multifunctional 'man.' Washington Post, Friday, October 16, 1981, D9.

Robots -- retraining of mechanics and technicians to use them. Training of ten mechanics and technicians from General Electric O. and the Pratt & Whitney Aircraft Group of United Technologies Corp. by ASEA, Inc., the U.S. arm of the Swedish industrial giant that is becoming a major supplier of robots to the U.S. market.

Discussion of present and future impact of robots on the work place, the problem of retraining, and the reaction of the labor unions to increased use of robotics.

106 Lund, R. T. Microprocessors and productivity: Cashing in our chips. Technology Review, January 1981, pp. 32-44.

Report of MIT study to examine the impacts of microprocessor use in existing applications in the United States. (funded by British Department of Industry).

Eight products selected for detailed study: (1) heating, ventilation and air-conditioning controls, (2) automobile ignition systems, (3) word processing devices, (4) electronic postage scales, (5) optical inspection systems in manufacturing, (6) medical equipment, (7) monitors for hydraulic cranes, (8) electronic sewing machines.

Study examined each application from three points of view: (1) What motivates the use of microprocessors? (2) What is involved in generating a successful microprocessor-based product? (3) What are the impacts of microprocessor applications on producers, users, job skills, and employment?

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107 Making sludge a fuel source. Nation's Business, October 1981, pp. 25-26.

A North Carolina firm is marketing a remarkable process that converts sludge into usable water and clean, burnable fuel. Raw sludge is pumped through a grinder, mixed with sulfuric acid, then sprayed into a pressurized chamber filled with oxygen and ozone. The oxygen and ozone cook the sludge chemically as it is recirculated. Bacteria and viruses are killed and the sulfuric acid provides hydrogen ions that react with the sludge to form water and carbon dioxide. All that takes 90 minutes and the residue has burning qualities similar to those of soft coal. The process is also economical, costing half the price of the conventional treatment.

108 Making the switch to drip. American Vegetable Grower, April 1981, p. 12.

Trickle (drip) irrigation of tomatoes is discussed. Description given of irrigation systems; comparison made to overhead irrigation. Report of increased yields, energy savings, reduced need for heavy fertilization and fungicide treatments. Weed control is easier; harvesting can continue during irrigation. Drip irrigation and plastic have made double-cropping possible.

109 Manley, B. The shape of things to come: A look at the electronic office. Telephony, 1981, 201 (10), 23-29.

Discusses trends toward multifunction office information processing systems (speech, data, text and image processing) which may replace a large share of paper copy and physical transmission. Key to systems will be sophisticated PABX (private automatic branch exchange) systems.

110 Mattson, W. Newspapers/new mechanical advantages. Marketing and Media Decisions, November 1981, pp. 76-78.

The trend toward offset printing, computerized pagination of classified ads and other newspaper page production computerized graphics, use of satellites and electronic publishing are revolutionizing the newspaper business today and are expected to bring continuing improvements.

111 McDonnell-Douglas unit introduces new CAD/CAM. American Metal Market, November 2, 1981, pp. 12, 16.

Notes growth potential for CAD/CAM in smaller businesses as a result of the introduction of a small-size single terminal system.

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112 Merchant, M.E. Computer-integrated manufacturing: Key to survival. Machine and Tool BLUE BOOK, November 1981, pp. 52-22.

There is a worldwide trend toward technical excellence leading to more efficient production. Achievement of this goal relies on computer-integrated manufacturing--the integration of numerical control, computer-aided design and computer-aided manufacturing. The computer is a systems tool capable of unifying all manufacturing into a computer-integrated manufacturing system, a system that starts from the human creative input, along with the input of needs to be satisfied by the product.

113 Micro-propagation. American Vegetable Grower, April 1981, p. 59.

A recent propagation technique that has beer explored at various places including the University of Wisconsin, is called micropropagation. This is simply a method of rapid multiplication of plants in a sterile "test tube" environment. Very rapid increases in disease-free cloned plants can be achieved independent of such things as weather and field conditions--from 20,000 to millions of plants can be generated annually using only a square foot of shelf space!

114 Microprocessor-based instrumentation: Better, more, and different. InTech, 1980, 27 (5), 9-24.

Discusses various measurement/control functions of instrumentation which are made possible or enhanced by microprocessors. Included are "intelligent" chromatographs, characterized pH controllers, safety warning systems, compressor control, combustion control, energy management, portable psychrometry, battery chargers, navigation and vehicle monitoring systems, automated test equipment. Gives technical references.

115 Miles, R.D., Summer, D.S., Russell, J.B., and Carlson, D.L. Computerized ultrasonic arteriography. Biomedical Sciences Instrumentation, 1980, 16, 81-86.

Pulsed-doppler ultrasound arteriography is an important development in carotid imaging for the diagnosis of atherosclerotic occlusive disease. Computer-aided graphics makes possible three-axis simultaneous display, which can enhance the effectiveness of this kind of imaging, such a system is described with regard to hardware and software.

116 Miller, M.L. Liquid fuels from biomass: Pros and cons. Agricultural Engineering, October 1981, pp. 26-27.

This article reports the results of a study by a task force of 22 engineers and scientists under the aegis of the ASAET-11 Energy Task Force. The report is entitled "The Biological Liquid Fuels Alternative." The report offers a more sober short-term outlook for alternative fuels than most media sources indicate. However, specific on-farm alternate fuel use may be more significant than that projected for the nation as a whole. Because the whole field is one of fast-changing technologies, the report notes that developments ahead may alter conclusions presented.

117 Mills, H.D. Software engineering education. Proceedings of the IEEE, 1980, 68, 1158-1162.

Commonalities and differences between university and vocational education in software engineering are discussed. Career structures and professional practices are organized and reviewed. New and developing computer technologies have diminished effectiveness unless the "software gap" is closed, it is asserted.

118 Morrison, G. Word processing in O.R. management. Dimensions in Health Service, March 1980, 57 (3), 18, 20.

A system is described which uses modern word processing technology to augment cost factor analysis associated with surgical procedures. Nursing staff is involved in planning and operating the system.

119 Myers, J.G. Marketing managers: Start assessing effects of computer video technology marriage, now. Marketing News, June 26, 1981, 14 (26), 1, 11.

Draws attention to videotex as a consumer information resource. Mentions computer/video systems as a new industry, as well as an advertising tool.

120 Neary, D.R. Microform and its potential in the office of the future. DM: Data Management, May 1979, 17 (5), 51-53, 56.

Data processing, word processing and image processing--bricks to be used in building new office configurations of the future. Image processing--particularly in microform, --will be an integral foundation. (1) COM equipment and software make microfilm more attractive. Dry COM processors use a laser beam to write on dry, heat-processed microfilm. (2) Second major micrographics development--intelligence in retrieval. Microimage terminals are microcomputer controlled and can be operated independently or interfaced with either minicomputers or large main-

frames. When used online in a computer-assisted-retrieval (CAR) mode, intelligent terminals relieve the host computer of other work.

121 Neiburger, E. J. Microsystems for the dental/medical office. Microcomputing, November 1981, pp. 48-51.

The dental/medical practice has unique problems that can be alleviated by computers. Appointments, insurance, billing, patient records, payroll and the like can be computerized giving the practitioner more control at less cost in time and money for the patient, the staff and the doctor.

122 Nelson, R.L. New developments in closed-loop combustion control using flue gas analysis. Analysis Instrumentation, 1980, 18, 71-83.

Describes new developments in combustion control systems used in controlled industrial heating applications. In-line flue gas analysers as well as microprocessor technology have been significant steps forward.

123 New horizons in water management. American Vegetable Grower, April 1981, pp. 14-20, 44-45, 48.

The water crisis facing the U. S. may be more severe than the present energy crisis. Growers must conserve existing supplies through efficient cultural and irrigation practices. Irrigation accounts for 81 percent of all water consumed in the U.S. and 53 percent of irrigation water comes from groundwater supplies. Trickle (drip) irrigation shows a lot of promise as a conservation method, especially when combined with plastic mulches. Transplants are also being used to save when watering seedlings. Dead levelling of fields (with laser beam levellers) makes it possible to control water flow. Low Energy Precision Application (LEPA) modifies a center pivot system and reduces water usage.

124 New point-of-sale computer displays moving ads and info. Marketing News, March 21, 1980, 13 (19), 6.

Reports introduction of small store-counter display for point-of-sale advertising, offering programmable moving light alphamerics.

125 New video technologies, social changes to fuel growth in direct-response marketing. Marketing News, May 15, 1981, 14 (23), sec. 2 p.4.

Videodisc and videotex (especially viewdata) are reviewed from the viewpoints of advertising/promotion and direct-response marketing, with examples for the service and entertainment industries.

126 No-waste waste. The Furrow, November/December 1978, pp. 30-31.

This article describes procedures and various recycling and uses of animal wastes. This is not a "new" idea, but a return to old technology with new applications, procedures, etc. Waste Management: Use of animal waste in farm ponds to grow algae to feed hogs and fish and grow water chestnuts. Treated and composted to feed cattle and dehydrated and used as fertilizer.

127 Norman, C. Microelectronics at work: Productivity and Jobs in the World Economy. Washington, D.C.: Worldwatch Institute, 1980.

An overview survey of microelectronics growth in a macroeconomic context. Provides an introduction to micronic circuits and microprocessors, examples of office and factory automation advances, and functional areas where jobs will be created as well as where they may be decreased.

128 O'Connor, T. In search of the office of the future. Bell Telephone Magazine, Edition 1, 1981, 60 (1), 2-13.

Today's Information Revolution may have greater impact on society than any previous technological change. The office of the future is a combination of communications, data processing, word processing, image/video transmission--where you have a single communications center which can do voice, data and image transmission on an integrated-nationwide basis. Nobody has that capability yet, but that's what the 80's are really all about--developing that capability.

129 On-line efficiency is key to survival. Purchasing, 1981, 91 (6), 79-83.

Describes the efficiency advantages of computers in order processing. Gives examples of training and organizational approaches geared toward the enhancement of workers' skills in interacting with computer-supported order/inventory systems.

130 Ouchi, W. "How Japan gets the most from its workers." San Francisco Chronicle, Tuesday, July 21, 1981, Section B-1.

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When an important decision needs to be made in a Japanese organization, everyone who will feel its impact is involved in making that decision. This article discusses the Theory Z approach to management. Probably the best known feature of Japanese organizations is their participative approach to decision making. Theory Z suggests that involved workers are the key to productivity.

131 Owens, J. Computerized estate planning. Microcomputing, October 1980, pp. 31-35.

Describes a personal computer program for estate planning through projections.

132 Paikert, C. Selling literature with the lettuce. Chain Store Age Executive, September 1981, p. 54.

Some supermarkets have opened full-line bookstores. Cookbooks and paperbacks related to food and diet make up approximately 15 percent of the bookstores titles. The idea is to help the supermarket attract and keep customers "We appeal to people in many ways. Why not appeal to thier intellectual appetites? And what better way than with bookstores?" says a supermarket corporate vice president.

133 Patterson, W. P. Who will keep the computers running? Industry Week, November 2, 1981, pp. 46-51.

Topics discussed: Statement of the problem--proliferation of computers and dearth of skilled maintenance personnel. Costs skyrocketing; companies and agencies pushed by vendors to do some of their own maintenance. Quotes on salaries, service rates, etc. Advent of vendors' remote diagnostic centers and computers diagnosing one another. Computer companies haven't gone all-out to expand their training programs. Tech schools turn out qualified people for whom there is tremendous competition.

134 Pauly, D., Contreras, J. and Marback, W.D. How to do it better. Newsweek, September 8, 1980, p. 59.

The notion of the "quality circle" wherein small teams of labor and management people are put together in a nonhierarchical setting and asked to spot and solve problems on the production line was developed in the United States in the late 1940's, but has found widespread acceptance and success in Japan. It is another tool for promoting productivity.

135 PCs edge out relays and computers. Purchasing, 1980, 89 (9), 122A4-122A7.

Provides an overview of programmable controllers (PCs) and their applications in industry.

136 Pierce, R.M. Through education we can grow. Journal of the American Optometric Association, 1981, 52 (1), 21-23; Scott, M. Education of the paraoptometric. Journal of the American Optometric Association, 1981, 52 (1), 31-34; Remke, J.W., Jr. Paraoptometric personnel: Selection and utilization. Journal of the American Optometric Association, 1981, 52 (1), 35-37.

These three related articles describe suggested training and utilization guidelines for paraoptometric personnel, and the need for people in paraoptometric roles.

137 Plant breeders report latest research findings. BioScience, 1981, 31, 488.

Briefly describes the process and applications of anther culture, a new technique for the rapid and controlled breeding of desirable plants.

138 Pratt, M. Will that compute? Agricultural Engineering. September 1981, pp. 10-11.

Article provides descriptions of applications of computers in agriculture, agricultural research, agribusiness and industry: (1) John Deere Dealer Audio Response Terminal System (DART); (2) Farm records--feed consumption and production, etc. (listing given of numerous practical on-farm computer uses); (3) Research on remote water and energy management system (WASC); (4) Microprocessor-based data acquisition systems; (5) Inventory control--by industry; (6) CAD/CAM for designing equipment; (7) Potentiometers for automotive and field-equipment operations. Among practical, on-farm computer uses mentioned are: financial and business records; management decisions, including market information and production records; automated production, monitoring and process control, including equipment monitors; equipment guidance; environmental control in confined animal and plant production systems; automatic control of materials handling; and optimal control of other energy-dependent processes.

139 Quality control circles at Westinghouse: A success story. The Maryland Workplace, (Newsletter of the Maryland Center for Productivity and Quality of Working Life), November/December 1979, 1 (5), 1-2.

Concise discussion of such questions as: What is a Quality Circle?; Who can use Quality Circles?; What's in it for the company?; What's in it for the Circle member?; Who's doing it?; Why the great interest in Quality Circles?; Are Quality Circles for manufacturing employees only?; What are the limitations?; and How would a company start a Quality Circle Program?

140 Rain, C. Nontraditional methods advance machining industry. High Technology, November/December 1981, 1 (2), 55-61.

Industry now uses about 30 nontraditional machining processes and more than 15,000 nontraditional machine tools, a number estimated to double over the next decade. The simple fact behind these developments is that materials are getting stronger, making them more difficult to machine by conventional means. Components are getting as tough as the cutting tools used to machine them. Machinability is hardly an issue in nontraditional machining, because sheer mechanical force is not relied on to remove metal. The newer machining processes don't punish the metal. Many operations in microdrilling would be impractical if not impossible using conventional methods.

141 Ranieri, M. A. Microprocessor-based control systems. Heating/Piping/Air Conditioning, August 1980, 52(8), 39-42.

Microprocessor-based control systems provide supervisory control over traditional temperature control sysems and provide the user with information as to how his building is performing with regards to energy consumption. The microprocessor is a tool the designer has at his disposal to implement system control. Article details functionality of microprocessors in environmental control, energy management, and total building management. Microelectronics is becoming increasingly important in the HVAC field.

142 Raskin, J. and Whitney, T. Perspectives on personal computing. IEEE Computer, January 1981, pp. 67-73.

Definition, brief history, discussion of types of problems, software, hardware, networks and future trends of personal computers.

143 Reichenberger, L. and Hoffman, R. Machinery trends in the '80s. Successful Farming in the South, February 1980, 78 (2), 21-30.

Predictions and descriptions of innovations in tractors, planters, tillage tools, combines, and sprayers which will be in use in the '80s. Larger size, greater power, inclusion of electronic sensors and control and guidance aids are among the changes coming.

144 Research--subsurface trickle irrigation. Seed World, November 1981, pp. 34,36.

New Irrigation Technique--Comparison of three irrigation methods: (1) electronic feedback from weather station; (2) direct electronic soil moisture readings and (3) furrow irrigation. Description of research on types of irrigation and reporting of outcomes. Trickle irrigation product yields were considerably higher when water amounts were accounted.

145 Retail bow for aseptic beverages. Packaging Digest, July 1981, pp. 36, 38, 39, 44.

Describes the spread of aseptic packaging, especially with regard to milk and fruit juices, to the United States. Forecasts expanded market penetration for these long shelf-life products.

146 Rhoades, R.J. Green thumb computing. Microcomputing, April, 1980, pp. 24-26.

Describes a personal computer program for garden planning.

147 Richey, C.B. Innovations in planters and seeders. Agricultural Engineering, February 1981, 62 (2), 16-17.

This article describes International Harvester's new Early Riser Cyclo Air Planters. High-speed photography and microprocessing of seed-drop action were used in research to improve the seeding rate for soybean planting. The optional Performance Center™ seed-drop monitor and microprocessor provide a versatile planter management and diagnostic tool.

Air grain seeders may be another example of the small manufacturer's willingness to take the risk of a revolutionary innovation while the large concern tends to wait until market acceptance has been demonstrated.

148 Riedlinger, T. Electrical vehicle battery fueled by aluminum plate. Modern Metals, pp. 68-75.

Prototype proves viability of aluminum-air battery for non-polluting, long-range electric vehicle that generates recyclable by-product. Development of cost-effective fuel alloys could trigger huge global market for aluminum, reduce dependence on imported oil.

149 Rilson, J.B. The automated office arrives. Telephone Engineer and Management, 1981, 85 (6), 53-70.

Describes the enhanced cabilities of PBX systems possible due to microelectronics. Indicates uses of "intelligent" user-programmable PBX systems for handling other than voice communications and for user-controlled networking. Growth and trends for the PBX market are shown.

150 Robinson, A.L. Micromainframe is newest computer on a chip. Science, 1 May 1981, 212, 527.

Announces development of a 32-bit high-level programmable computer miniaturized to sell at low cost. Programming will remain the major cost consideration in application.

151 Rodgers, R. C. Heating up productivity with supersmart controls. Production Engineering, September 1981, pp. 58-62.

NC which is either CNC or DNC and process control computers have been streamlined in size, performance and ease of programming with the help of computer-on-a-chip microprocessors and dramatic advances in memory technologies.

152 Roworth, D.A.A. Fiber optics for industrial applications. Optics and Laser Technology, 1980, 12, 255-259.

Overviews current and expanding areas of fiber optics use (e.g., in communications), and predicts growth in local industrial communications usage. Fiber optic data transmission is described technically.

153 Ryther, J.J. Mariculture, ocean ranching, and other culture-based fisheries. BioScience, 1981, 31, 223-230.

Describes the various techniques of aquaculture/mariculture, the extent of current application, and world trends. Treats the contribution of these methods to increased food production. Several different approaches, applicable to the culture of various genera, are covered.

154 Schaldach, M.K. Operator interfaces for programmable controllers. InTech, 1981, 28 (9), 63-65.

Discusses and illustrates some basic and advanced operator interfaces which can be implemented in programmable controller systems.

155 Schenker, W. J., MD. A menu-driven, touch panel microcomputer for clinical recordkeeping. Medical Instrumentation, November/December 1980, 14(6), 301-304.

Recording, access, and storage of patient records by using a computer system. Disadvantages of handwritten note records or dictation of medical records. Advantages of using a low-cost, menu-driven, touch-panel microcomputer for physician use.

156 Schippers, P.A. Commercial hydroponic production (greenhouse lettuce). American Vegetable Grower, October 1981, pp. 9-10.

This article presents a description and discussion of the process, facilities, problems and successes of hydroponic production of lettuce.

157 Schultz, J.K. Nursing and technology. Medical Instrumentation, 1980, 14, 211-213.

Advances in technology (such as implantable devices, intravenous flowmeters, closed-circuit television, microsurgery, etc.) are expanding the roles of, and placing new demands on nursing staff. Article gives examples of new nursing responsibilities and argues that nursing education, not just "first job" experience, must prepare personnel for these functions.

158 Schuster, S.A. Relational database management for online transaction processing. Data Management, 1981, 19 (10), 55-57.

There are three basic data models (organizational schemes) which can form the logical substrate of a database management system (DBMS). The "relational" model is the newest development. Relational models' general characteristics (including user-orientation) are described.

159 Sewell, M.L. The role of programmable controllers as remote terminal units. Instrumentation in the Chemical and Petroleum Industries, 1979, 15, 91-92.

Discusses programmable controllers in supervisory control and monitoring systems, for pipelines and in other applications.

160 Sheppard, L.C. The computer in the care of critically ill patients. Proceedings of the IEEE, 1979, 67, 1300-1306.

Describes applications of computer systems in intensive and cardiac care. The importance of clinical measurements in critical care is shown, and an example system is described which measures and charts physiological parameters as well as helping with drug prescription. Organizational environments conducive to system implementation are described.

161 Shumate, K.C. Ada--A new language that will impact commercial users. Data Management, 1981, 19 (8), 23, 25.

Describes business applications of the high-level programming language Ada and its special features. Ada was originally developed by DoD but is expected to find expanding use wherever large programs must be written and maintained over a long period of time, e.g., in operating systems, compilers, communication systems and simulation systems.

162 Skarien, K. Thoughts--"Thresher run" column. Seedsmen's Digest, July 1981, pp. 6-9.

Among the important topics today in biotechnology are: monoclonal antibodies, tissue culture, and recombinant DNA which are defined and discussed briefly in this article. There are exciting prospects for the future in biotechnology.

Agriculture, with its diversity of crops and livestock, has a real investment in genetic engineering. Plant breeders are the original genetic engineers.

163 Smith, L. A. and Schafer, R. L. Automatic guidance for agricultural machinery. Agricultural Engineering. September 1981, 62(9), 12-14.

Article discusses the potential for automatic guidance of agricultural machine systems. Description given of feasible guidance system which has been tested by a team at the National Tillage Machinery Laboratory at Auburn, AL (USDA-ARS engineers). Missing link--a suitable spatial position sensing device for accurately locating the machine in the field.

164 Sofaly, K.J. The nurse and electronic data processing. Medical Instrumentation, 1981, 14, 169-170.

Electronic data processing and data handling are treated with respect to changing task demands for nurses.

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165 Somers, E. Medical devices in the 1980s. Dimensions in Health Service, October 1979, 56 (10), 27-28.

Provides a brief assessment of expected growth in certain medical technologies, including fetal monitoring systems, implantable infusion pumps, and implantable telemetry monitors.

166 Soni, V.P. The metamorphosis of the medical technologist. Dimensions in Health Service, March 1981, 58 (3), 22-23.

Due to changes in economic factors and to technological advances, the roles of nurses, medical social workers, and physician assistants, as well as medical technologists, will change. Radiologic technology is mentioned in particular as a field changing due to high technology as well as to manpower/delivery system needs.

167 Spalding, I.J. High-power lasers--their industrial and fusion applications. Optics and Laser Technology, 1980, 12, 187-197.

Besides discussing applications in experimental physics, this article describes the application of laser technology for welding, glazing, drilling, alloying, cutting, and hardening, in various industries where these processes are used. Growth trends are noted for the industry. A technical overview of the high-power laser process for spot heating is given.

168 Stoecker, W. F. Computer applications to supermarkets. Heating/Piping/Air Conditioning, August 1980, 52(8), 55-57.

The major purposes of computer control systems for supermarkets are to conserve energy and to protect food products and equipment while providing comfortable conditions for shoppers. Air conditioning requirements of a supermarket are unique because concentrated refrigeration sometimes overcools certain areas of the store. Monitoring systems that report store temperature, equipment malfunctions, and that can act as timers to shut off energy using equipment when it is not needed can save energy while reducing maintenance costs.

169 Swanson, K. An advanced combustion control system using distributed microcomputer techniques. Analysis Instrumentation, 1981, 19, 111-116.

Points out the use of microprocessor controls in complex combustion control (furnace) systems.

170 Technical survey -- Fiber optics 1. Aviation Week and Space Technology, October 12, 1981, 115 (15), 44.

Aerospace, military applications of fiber optics currently in improved C^3 systems-command, control and communications. Somewhat later significant applications are in guidance and control systems for aircraft, spacecraft and missiles, optically multiplexed data bus transmission systems, electronic warfare and advanced instrumentation system. *The total market in fiber optics is expected to soar in the next decade, with consumption of components in the U.S. commercial telecommunications market reaching the billion dollar per year level by 1990.

Present government/military expenditures, estimated at $41 for the current year, are expected to grow to $168 million in 1985 and reach $388 million by 1990.

171 Tesar, Delbert. Our weakening trade position in manufactured goods: A commentary on mechanical technology. PE Professional Engineer, August 1979, 49 (8), pp. 34-36.

This article discusses the effects of our lack of R&D emphasis on Mechanical Technology as compared to our trading partners in Europe and Asia. Our lagging efforts have brought about a decrease in productivity and a consequent superiority by other nations such as Japan and West Germany. Recommendations are presented for the solution of the problem. They include: a cohesive and structured national program for mechanical technology and manufacturing; the establishment of ten technology centers; heavy participation of industrial governing boards in these centers; substantial initial federal funding; and others. The nature of mechanical technology and robot technology are discussed.

172 Thome, R.J., Cline, M.W., and Grillo, J.A. Batch Process Automation. Instrumentation in the Chemical and Petroleum Industries, 1980, 16, 95-101.

Describes functioning systems used by Merck & Co. to control processes, tests, and energy usage, as well as other operations, in batch chemical production. Operator interface and programming considerations for digital batch process control systems are covered.

173 Thompson, R.A. Direct digital control of batch processes. Instrumentation in the Chemical and Petroleum Industries, 1980, 16, 53-70.

Direct digital control (DDC) systems are described, with reference to industrial batch processes in chemical production. Operator interface is treated with respect to alarm displays and to overview control of single- and multiple-batch operations.

174 Thorndike, J. The unearthly world of hydroponics. Horticulture, November 1980, pp. 24-31.

Hydroponics, or growing plants in soil-less materials or a nutrient solution, often works better than growing them in soil. The plants don't know the difference. Hydroponic installations are more expensive than field culture, but many greenhouse operations are turning to hydroponics or other soil-less propagation methods.

175 Thornton, J. Robots--Is long-expected boom under way? American Metal Market, October 12, 1981, pp. 12, 14, 17.

A report on projections for robotics in automotive and other machine-tooling industry expressed at a conference on "Robots' Contribution to Productivity."

176 Tolchin, S.G. and Stewart, R.L. The distributed processing approach to hospital information processing. Journal of Medical Systems, 1981, 5, 345-360.

Describes technical parameters and some applications of distributed data processing (DDP) systems in hospitals. Fiber optic hardware for local distributed communication is described, and systems using these network interface units are treated.

177 Triplett, R. D. Current developments in induction cooktops. In Current developments in home appliances (Proceedings of the National Technical Conference of College Educators in Home Economics). Chicago: Association of Home Appliance Manufacturers, 1980, pp. 6-11.

Describes the principles underlying magnetic induction cooking. Predicts growth in market penetration. Describes energy-saving and convenience advantages of induction-based ranges.

178 Tsichritzis, D.C., and Lochovsky, F.H. Office information systems: Challenge for the 80's. Proceedings of the IEEE, 1980, 68, 1054-1059.

Office information systems are described, especially with reference to problems and bottlenecks to implementation. User

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requirements, as well as several of the separate technologies of the "office of the future," are touched on. Industry trends and market forces are discussed.

179 Tucker, B.D. Portable appliance versatility -- New directions. In New demands -- New directions, (Report of the 29th National Home Appliance Conference). Chicago: Association of Home Appliances Manufacturers, 1978, pp. 59-64.

Discusses novel, imaginative, and expanded uses of modern kitchen appliances such as blenders, juicers, small-serving grills, slow cookers, etc.

180 Vaccinating chick embryos through shells in successful. Chemical and Engineering News, 1981, 59 (35), 10.

Announces success of egg-stage vaccination of poultry against Marek's disease.

181 Vail, H. The automated office. The Futurist, April 1978, pp. 73-78.

Automation has already revolutionized the factory. Now it is about to revolutionize the office -- freeing workers from rigid schedules, busy work, and the aggravations of commuting.

The telephone is now speeding the development of the electronic office. Today's worldwide telephone network means that portable computer terminals can be carried and used almost anywhere. Word processing equipment is revolutionizing the way in which letters and other documents are written, corrected and reproduced.

182 Vo-Dinh, T. New luminescence techniques simplify air analysis. InTech, 1981, 28 (5), 45-48.

Flourescence spectrometry is the most sensitive technique available for the quantitative analysis of certain compounds in air samples, offering advantages over gas chromatography.

183 Waddell, R.L. Automotive electronics--The black box comes of age. Ward's Auto World, Novemher 1980, pp. 23-26.

With few exceptions, every gasoline-powered passenger car that comes off the line for sale in the U.S. from now on will be controlled, one way or another, through integrated semiconductor-chip circuitry compacted in mysterious black boxes whose potential usefulness has only begun to be tapped. The

need stems from the inability of mechanical or electromechanical devices to respond fast enough with sufficient accuracy to meet emission standards set by the EPA and still deliver engine performance and fuel economy demanded in today's automotive marketplace. The article discusses state-of-the-art automobile electronics and projections for the future.

184 Walton, S. Biocontrol agents prey on pests and pathogens. BioScience, 1980, 30, 445-447.

Describes some features of biological control, one of the integrated pest management (IPM) substrategies, in the control of fungal, microbial, insect, and weed pests. Involves the use of host-specific antagonistic organisms.

185 Welding for the '80s. Welding Design and Fabrication, November 1980, Special Issue.

This issue presents articles on welding as applied to the major areas of Power, Heavy Vehicles, Construction and Transportation. State-of-the-Art information and projections for the next five to ten years are given.

186 Welland, S. Micrographics in the office of the future. Journal of Micrographics, November/December 1978, 12 (2), 85-88.

The role micrographics will play in the office of the future depends on how well it integrates with future equipment and systems. This integration and the various opportunities that will exist in the future can be evaluated by employing the seven components of the business communications system: creation, capture, input to a processor, expansion, distribution, storage and retrieval and disposal. This presentation will illustrate and evaluate the role of micrographics in the office of the future employing these components. Also discussed are the risks of alternatives to micrographics, which may diminish its role in the future office, such as mass electronic storage and local computer storage.

187 Wennerberg, A. L. Current developments in electronic controls. In Current developments in home appliances (Proceedings of the National Technical Conference of College Educators in Home Economics). Chicago: Association of Home Appliance Manufacturers, 1980, pp. 12-14.

Discusses applications and trends in electronic and microprocessor controls for appliances. Functions that are in place or can be expected in the near future are listed for appliances

such as washers/dryers, ranges, refrigerator/freezers, and room air conditioners. Advantages cited include convenience, accuracy, reliability, and decreased energy consumption.

188 Whalen, B.F. Videotex: Moving from blue sky to black ink. Marketing News, October 3, 1980, pp. 1, 6-7.

Discusses trends, applications, and market projections for videotex, particularly teletext systems.

189 What the office equipment makers are selling this year. Purchasing, 1981, 90 (12), 91-100.

Reviews some of the newer products and options for the "office of the future." Included are products for electronic mail, micrographics, word processing and others. Points out that the purchaser will need to be knowledgeable about integrating these systems for handling a wide range of "paperless office" tasks.

190 Wiederhold, G. Database technology in health care. Journal of Medical Systems, 1981, 5, 175-196.

The use of database management systems (DBMS) in various medical and health care management applications is treated. Such systems and operator interfaces are generally described.

191 Wiegand, B.A. Three-dimensional interactive computer-aided design and manufacture of mechanical structures. RCA Engineer, 1981, 26 (6), 51-57.

A three-dimensional CAD/CAM system is described, which can reduce the number of discrete steps and the number of errors from design to finished part in the fabrication of machine parts.

192 Will materials change shape of tomorrow's machine tool industry? Iron Age, June 22, 1981, pp. 87-104.

Technical change is changing the machine tool industry. Some of the trends were noted by the CEO of a leading machine tool company as (1) the application of advanced electronics and the integration of them more closely with our machinery products; (2) the development of software which is directly related to getting work done in a factory environment; (3) robotics, including sensors; and (4) R&D aimed at the conversion of many

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parts and products from conventional materials--metal, glass, wood, to some form of plastics. The trend will continue toward the conversion of automotive parts from metal to some form of plastics.

193 Williams, V.A. Cutting tools spark productivity gains. Production, April 1980, 85 (4), 72-76.

Cutting tools are the critical link between raw materials and finished products. Most of the recent improvements in cutting tools are in the area of carbide inserts. These include new and improved grades of carbide, coated carbides, different shape inserts, various types of chip breakers, choice of rake angles and a wide selection of mechanical methods for retaining the inserts. The carbide insert drill ranks among the most significant developments in the last decade in metalcutting.

194 Williams, V.A. Drilling speeds increased ten-fold. Production, January 1980, pp. 84-89.

Carbide insert drills represent one of the most significant technological advancements since the twist drill was invented. They drill holes up to ten times faster than conventional drills. In the majority of today's highly complex production manufacturing operations, the highest cost factors are direct labor and machine operating time. Reducing either of these factors can make a significant contribution to overall company profits. Changing to carbide insert drills represents one of the fastest approaches to cutting both direct labor and machine operating time and effectively boosting profits. (author)

195 Wittwer, S.H. Food production trends. Up Front: Agricultural Engineering, July 1981, 62 (7), 14-16.

There are two general types of food production technologies for the future--mechanical-labor-saving and land-resource-intensive, on the one hand, and biological-chemical or land-resource-sparing, on the other hand. The future will show a worldwide shift from less of a natural-resource based to a more science-based agriculture. The emphasis will be to raise output per unit resource input and release the constraints imposed by relatively inelastic supplies of land, water, fertilizer, pesticides, and energy.

It is projected now that almost all future increases in food production will be a result of increases in yield (output per unit land per unit time) and from growing additional crops during a given year on the same land. There are really no other viable options. Greater investments in research offer our principal hope. (author)

196 Wohl, A.D. Office of the future--Close, but still elusive. The Office, January 1981, 93 (1), 93-94, 190.

Office is a dynamic place and its future is a dynamic, not a static goal. Changes in technology offerings, but also changes in attitudes and goals. Word processing--many firms saying they want to fit word processing into existing traditional secretarial structures (Has to get cheaper because sec. will use it only 20 percent of workday) or has to support a lot more than the typing function--Both of these things are happening; not just word processing anymore--has grown into local data processing, photocomposition and administrative services. Office automation recognized as a key component in increasing office productivity.

197 Wohl, A.D. What's word processing? It's attitudes, not equipment. DM: Data Management, May 1979, 17 (5), 39-41.

Vendor of word processing equipment influences definition of concept/role. Word processing is central to a number of office automation issues. Office automation is considered to be a part of a larger issue--information processing.

Key issues: Control of equipment section
Equipment compatibility

Writer believes office of the future may offer a lot of local processing and the ability to hook things together when and as they are needed. (Requiring compatibility and integration.)

198 Wolpert, T. You and your computer--Designed for productivity. Venture, January 1982, pp. 24-26.

A CAD system brings the same efficiency and speed to architectural and engineering design that traditional computer functions bring to tasks such as inventory control. Most computers used for standard business applications are only required to display combinations of numerals, letters and symbols on pre-determined lines on the computer's screen. A CAD system, on the other hand, can display infinite combinations of lines, arcs, vectors, and numbers and letters. As a result, CAD systems require larger memories and data storage capabilities than standard business systesm.

In addition to manufacturers, architects, furniture and other types of designers and a company which provides topographical maps to utilities, construction companies and municipalities are using CAD systems successfully.

199 Woodin, G.B. Aquaculture: A source for fish gears up for future growth. Aquaculture Magazine, January 1981, pp. 32-34.

Fish farming is expected to grow from a 1979 value of shipments of $89 million to $500 million by 1989--an increase of better than 500 percent. Both major firms and hundreds of small companies and entrepreneurs have taken steps to enter the aquaculture market.

200 Worthy, W. Supercritical fluids offer improved separations. Chemical and Engineering News, 1981, 59 (31), 16-17.

Overviews the use of supercritical fluids (SCF; gases compressed to densities approximating liquid) in a new chemical extraction/separation technology. The process capitalizes on physical properties of SCFs to result in effects similar to usual fractional distillation. SCF extraction technology is being investigated as an energy-efficient alternative in the production of ethanol, specialty chemicals and biologicals; in processing of potato chips and similar products; in the extraction of oil from seed; and in other applications.

201 Wrigley, A. Flying high: Materials in the '82s. Ward's Auto World, September 1981, pp. 45-50.

Materials substitution heads the list for '82 weight-reduction innovations by U.S. automakers. Aluminum, plastics, magnesium and high-strength steel (HSS) are all being used, along with more galvanized steel for better corrosion resistance. Downsizing--replacement of smaller models for larger ones--continues as the industry's chief weight-saving weapon, of course, but the materials mentioned constitute a much larger unit content in the '82 models than in previous years' models.

202 Wrigley, A. Strong medicine: Materials in the 1981 models. Ward's Auto World, September 1980, pp. 41-45.

Not all of the substitutions of materials being made by U.S automakers are aimed solely at helping Detroit stretch its miles per gallon capability. Corrosion resistance, durability, crash-worthiness, lower assembly cost and styling incentives also come into play. Aluminum cylinder heads in small engines are the first aluminum units to be mass-produced here in modern times. Flexible-plastic "friendly fenders" are a production first on a U.S. car. High strength steel, magnesium, fiberglass-reinforced plastic, and galvanized steel are also being used.

203 Xerox uses "Supermarket Stockroom" approach. Purchasing, 1980, 89 (8), 79-80.

Describes one company's internal stock handling/transfer system, which uses computer systems and op/scan methods.

APPENDIX C

Bibliographic Reference Card

PROJECT:	TITLE:	AUTHOR:

PUBLISHER (Place, Name):	DATE:	VOL. NO.:	PAGES:
	ID NO.:		

SOURCE:	IDENTIFICATION METHOD:	TYPE OF DOCUMENT:

ABSTRACT:

APPENDIX D

Technology Rating Sheet

RATING OF TECHNOLOGIES

CANDIDATE TECHNOLOGY _____

Applicability to Vocational Education: 1 2 3 4 5

Limited Somewhat Direct

Extent of Current Use: 1 2 3 4 5

Limited Moderate Extensive

Assurance of Wide Diffusion Within the Next Three to Five Years: 1 2 3 4 5

Uncertain Good Possibility Near Certainty

Sum of ratings _____

APPENDIX E

Vocational Education Instructional Program Codes

*From Vocational Education Data System (VEDS), NCES Reporting Form 2404

VOCATIONAL EDUCATION INSTRUCTIONAL PROGRAMS*

Instructional Program (01.0100-07.0303)	
01.0100	Agricultural Production
01.0200	Agricultural Supplies/Services
01.0300	Agricultural Mechanics
01.0400	Agricultural Products
01.0500	Horticulture
01.0600	Renewable Natural Resources
01.0700	Forestry
01.9900	Other Agriculture
04.0100	Advertising Services
04.0200	Apparel & Accessories
04.0300	Automotive
04.0400	Finance & Credit
04.0500	Floristry
04.0600	Food Distribution
04.0700	Food Services
04.0800	General Merchandise
04.0900	Hardware, Building Materials, etc
04.1000	Home Furnishings
04.1100	Hotel & Lodging
04.1200	Industrial Marketing
04.1300	Insurance
04.1500	Personal Services
04.1700	Real Estate
04.1800	Recreation & Tourism
04.1900	Transportation
04.2000	Other Retail Trades
04.9900	Other Distributive Education
07.0101	Dental Assisting
07.0102	Dental Hygiene (Associate Degree)
07.0103	Dental Laboratory Technology
07.0203	Medical Laboratory Assisting
07.0299	Other Medical Laboratory Technology
07.0301	Nursing (Associate Degree)
07.0302	Practical (Vocational) Nursing
07.0303	Nursing Assistance (Aide)

Instructional Program (07.0399-16.0117)	
07.0399	Other Nursing
07.0400	Rehabilitation
07.0501	Radiologic Technology (X-ray)
07.0800	Mental Health Technology
07.0903	Inhalation Therapy
07.0904	Medical Assistant
07.0906	Community Health Aide
07.0907	Medical Emergency Technician
07.[illegible]00	Other Health Occupations Education
09.0201	Care & Guidance of Children
09.0202	Clothing Mgt., Production, & Services
09.0203	Food Mgt., Production, & Services
09.0204	Home Furn., Equipment, & Services
09.0205	Institutional & Home Mgt. & Sup.
09.0299	Other Occup. Prep. for Homemaking
14.0100	Accounting & Computing Occupations
14.0201	Computer & Console Operators
14.0203	Programmers
14.0299	Other Business Data Processing
14.0300	Filing, Office Machines, & Gen. Off.
14.0400	Information, Communication Occup.
14.0500	Materials Support Occupations
14.0600	Personnel, Training, & Related
14.0700	Stenographic, Secretarial, & Related
14.0800	Supervisory & Administrative Mgt.
14.0900	Typing & Related Occupations
14.9900	Other Office Occupations
16.0103	Architectural Technology
16.0104	Automotive Technology
16.0106	Civil Technology
16.0107	Electrical Technology
16.0108	Electronic Technology
16.0110	Environmental-control Technology
16.0111	Industrial Technology
16.0113	Mechanical Technology
16.0117	Scientific Data Processing

Instructional Program (16.0601-17.2700)	
16.0601	Commercial Pilot Training
16.0602	Fire & Fire Safety Technology
16.0605	Police Science Technology
16.9900	Other Technical Education
16.9902	Water & Waste Water Technology
17.0100	Air Conditioning
17.0200	Appliance Repair
17.0301	Body & Fender Repair
17.0302	Auto Mechanics
17.0303	Automotive Specialization
17.0400	Aviation Occupations
17.0700	Commercial Art Occupations
17.0900	Commercial Photography Occup.
17.1001	Carpentry
17.1002	Electricity
17.1004	Masonry
17.1007	Plumbing & Pipefitting
17.1099	Other Construction & Maintenance
17.1100	Custodial Services
17.1200	Diesel Mechanic
17.1300	Drafting Occupations
17.1400	Electrical Occupations
17.1500	Electronics Occupations
17.1700	Foremanship, Super., & Mgt. Devel.
17.1900	Graphic Arts Occupations
17.2100	Instrument Maintenance & Repair
17.2200	Maritime Occupations
17.2302	Machine Shop
17.2303	Machine Tool Operation
17.2305	Sheet Metal
17.2306	Welding & Cutting
17.2307	Tool & Die Making
17.2399	Other Metalworking Occupations
17.2400	Metallurgy Occupations
17.2602	Cosmetology
17.2699	Other Personal Services
17.2700	Plastics Occupations

Instructional Program (17.2801-17.9900)	
17.2801	Fireman Training
17.2802	Law Enforcement Training
17.2899	Other Public Service Occupations
17.2900	Quantity Food Occupations
17.3000	Refrigeration
17.3100	Small Engine Repair
17.3200	Stationary Energy Sources Occup.
17.3300	Textile Production & Fabrication
17.3500	Upholstering
17.3600	Woodworking Occupations
17.9900	Other Trade & Industrial Occupations
OTHER (Specify if more than 1%)	
OTHER (Less than 1% of Total)	
TOTAL (Pages 1, 5, 9, and 13)	

*From Vocational Education Data System (VEDS), NCES Reporting Form 2404